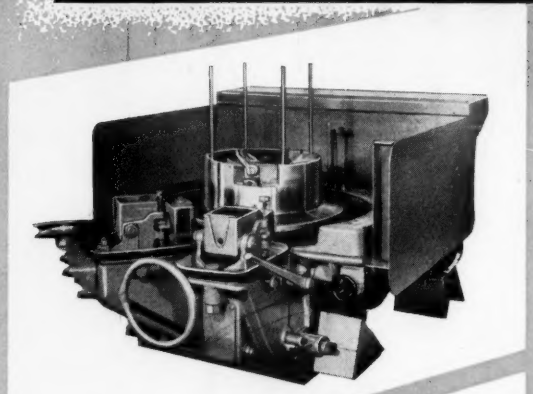
JANUARY 1943

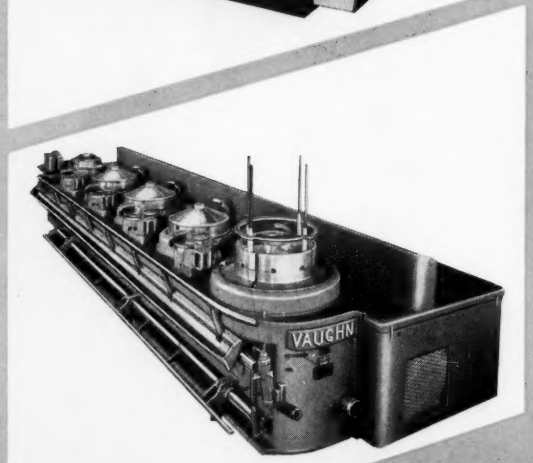
WIRE AND WIRE PRODUCTS

2-5988

SWORDS NOW....

Ploughshares Tomorrow...





OUTSTANDING PERFORMERS IN EITHER ROLE!

Vaughn

MOTOBLOC AND MOTOBLOX

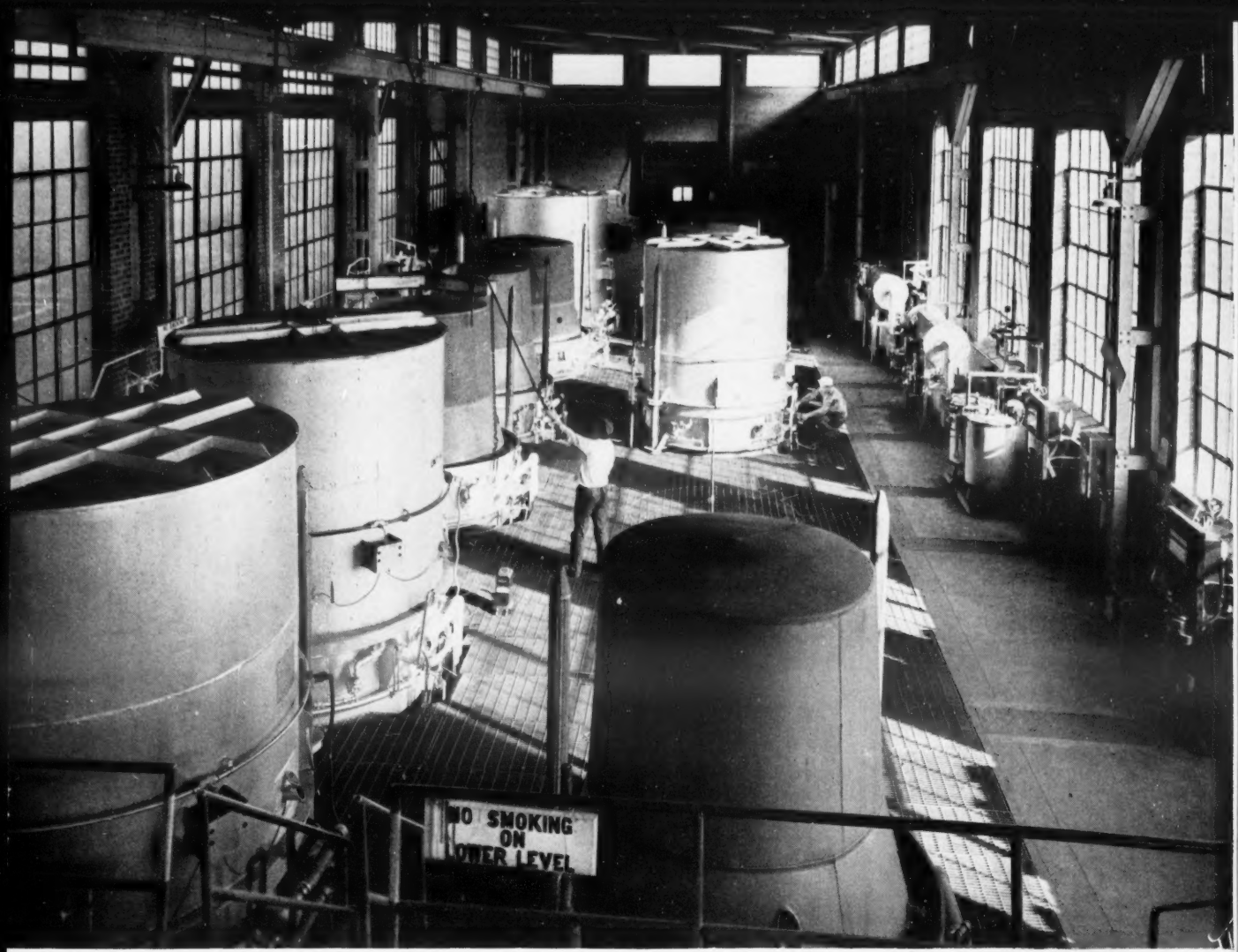
Not just the best machines for producing quickly a wide variety of high quality wire for victory now . . . but because of their famous features of Safety, Flexibility, and Controlled Speed—the ideal machines to meet successfully your post war demands.

THE VAUGHN MACHINERY CO.

CUYAHOGA FALLS, OHIO, U. S. A.

Complete Cold Drawing Equipment . . . Continuous or Single Hole . . . For the Largest Bars and Tubes . . . For the Smallest Wire . . . Ferrous, Non-Ferrous Materials or Their Alloys.

OFFICIAL PUBLICATION OF THE WIRE ASSOCIATION



WIRE ANNEALING at its Best

ATLANTIC WIRE Company

Branford . . . . . Conn.

With ATMOSPHERIC CONTROL FOR CARBON STEEL TO 52100 and FOR ALLOYS OF ALL ANALYSES

COMPLETELY DESIGNED and ENGINEERED by

Lee Wilson ENGINEERING Co., Inc.

20005 West Lake Road CLEVELAND, OHIO

Telephone ACademy 4670

SEE FEBRUARY ISSUE FOR STORY ABOUT THIS INSTALLATION

CARBOLOY CEMENTED CARBIDE DIES Can Be Made Up To 18 INCHES I.D.

War has caused a steadily increasing demand for Carboloy Cemented Carbide Dies in large sizes—sizes that in some cases, were impossible to produce a year or two ago. They are available today due to a program of development that has been carried on continuously since the introduction of Carboloy Cemented Carbides more than a decade ago . . . a period that included many lean, profitless, depression years.

Today, Carboloy Cemented Carbide Dies can be made in sizes up to 18 inches I.D. This unusual size range is available to speed war work on the drawing of bars, tubes, shell cases and the drawing and forming of sheet metal parts. To help you with this work is an organization with the equipment, the trained personnel and the experience that has made this possible.

CARBOLOY COMPANY, INC., DETROIT, MICHIGAN

Sole makers of the Carboloy brand of cemented carbides

CHICAGO • CLEVELAND • LOS ANGELES • NEWARK • PHILADELPHIA • PITTSBURGH • SEATTLE

Authorized Distributors: Hartley Wire Die Co., Thomaston, Conn.; Michigan Wire Die Co., Detroit; Canadian General Electric Co., Ltd., Toronto

CARBOLOY TRADEMARK **CEMENTED CARBIDES** TRADEMARK

COMPLETE DIE SERVICE FOR WIRE, BAR, TUBING AND SHEET METAL

FOR OUR ARMED FORCES

INDUSTRIAL AMERICA HAS PLEDGED

ALL-OUT AND EVER-INCREASING PRODUCTION

FOR OUR ARMED FORCES

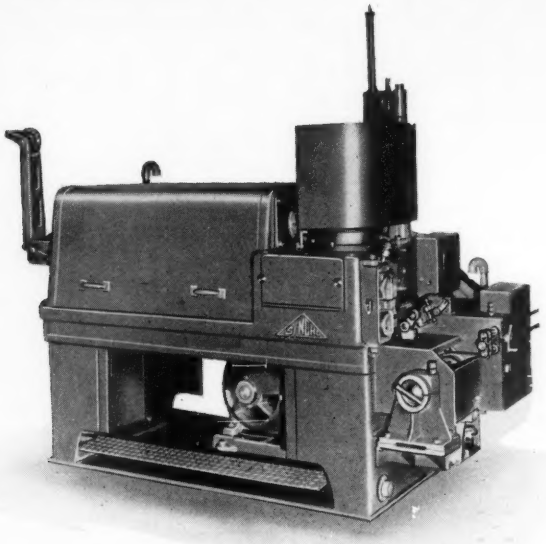
—THAT THEY MAY QUICKEN THE DAY OF VICTORY

—THAT THEY MAY RETURN IN SAFETY

—AND THAT THE WORLD MAY BE ASSURED

OF A LASTING PEACE

Conserve with.....



SYNCRO B B S

Coiling and spooling machine with A.C. drive and Syncro "Free-Wheeling" system of control, including magnetic slip clutch driven spooler. Maximum entering wire #16 W & M gauge and with proportionate entering size, can finish to #48 W & M gauge.

Syncro A. C. *Driven* continuous *steel* wire drawing machines

The basic advantages of A.C. drive are as follows:

- It conserves critical materials
- A lower initial investment is required
- It permits selection of definite speeds
- It assures constant production at selected speeds
- It requires the very minimum of control equipment
- It permits compact design resulting in a saving of valuable floor space
- It is highly efficient and requires the minimum of operator skill

All of these basic advantages you get in Syncro Wire Drawing Machines for either ferrous or non-ferrous wire—plus the many other advantages inherent in Syncro's modern design.

SYNCRO MACHINE COMPANY

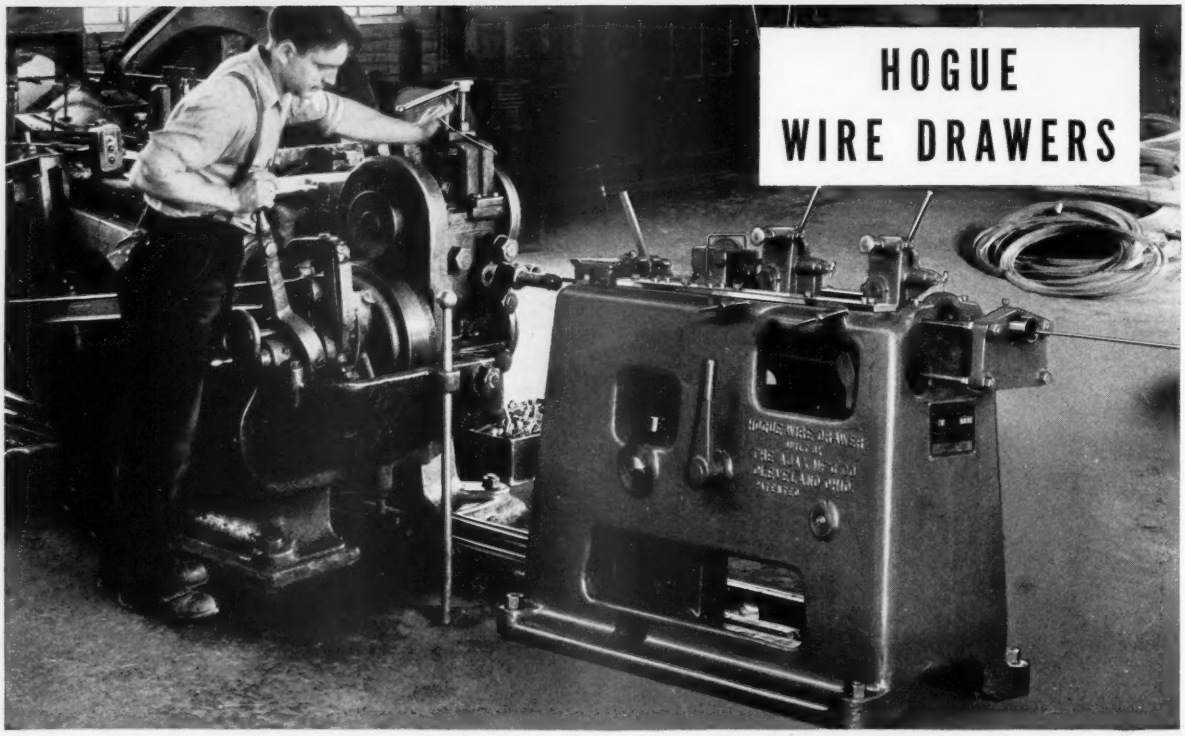
RAHWAY, NEW JERSEY
McCORMICK BLDG., CHICAGO

REPRESENTED IN CANADA BY CANADIAN ELEVATOR EQUIPMENT CO. LTD., TORONTO

Machinery for the Wire Industry

SYNCRO

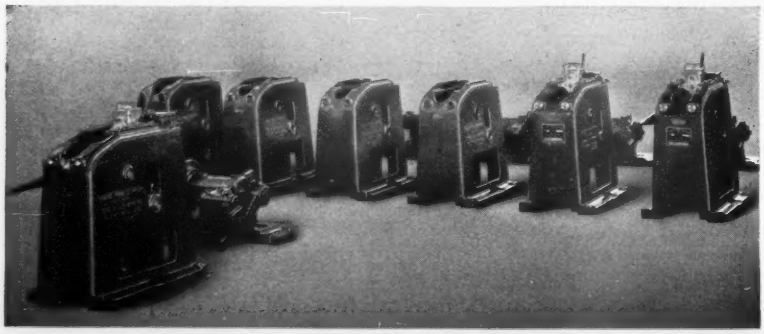
AJAX



REDUCE COLD HEADING DIE COSTS

Increase header die life—Substantially longer heading die life, especially for close specification products, and increased operating efficiency result from straight, accurate, clean and freshly-drawn wire free from age hardening and gritty accumulation.

Increase Profits—Because of savings in heading die costs and lower drawing costs, even in plants which already have their own cold drawing department, profits are substantially increased by the use of Ajax Hogue Wire Drawers.



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This repeat order for seven Ajax Hogue Wire Drawers, from a company already operating its own cold drawing department, was the result of the profits from a trial installation.

Write for Bulletin No. 111

THE AJAX MANUFACTURING COMPANY
EUCLID BRANCH P. O., CLEVELAND
621 MARQUETTE BUILDING
CHICAGO, ILL.

Heads WIN..

whether you are fighting the wiley Japs or building equipment for the fight.

Carl-Mayer achievements have proved that it takes CREATIVE ENGINEERING (real head work) to meet emergency production demands quickly and at lowest cost for labor and fuel.

Many of America's outstanding concerns are Carl-Mayer customers.

Wire for a Carl-Mayer Engineer, or write for Bulletin 241.

OVER TWENTY YEARS' EXPERIENCE

CARL-MAYER HI-SPEED TRADE MARK ROD BAKERS

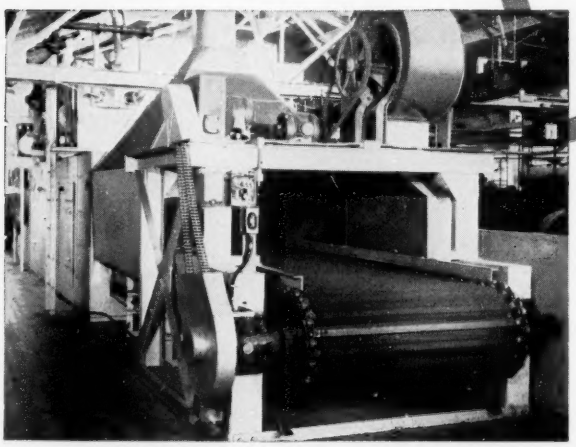
The fastest rod bakers built. Save 50% in time and fuel.

CARL-MAYER WELDING ROD OVENS

For drying coated welding rods speedily, efficiently and economically.

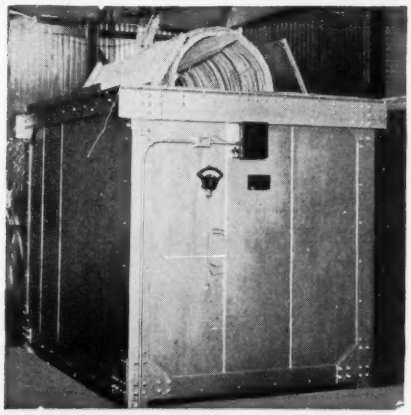
CARL-MAYER INDUSTRIAL FURNACES

For stress relief, drawing, tempering and heat treating. Fast heating cycle, and amazing uniformity of temperature.



CARL-MAYER SHOT AND SHELL FURNACE

Built for stress relieving shot and shells from 20 to 105 mm. Carl-Mayer Recirculating Air Heater Furnaces are used in many of America's leading plants.



CARL-MAYER HI-SPEED ROD BAKER

Besides its super-speed and fuel economy, this rod baker has an exclusive Blow-Off Feature which removes moisture without bumping or agitating the coils. Patented and patents pending.

CARL-MAYER, 3030 Euclid Ave., CLEVELAND, O.

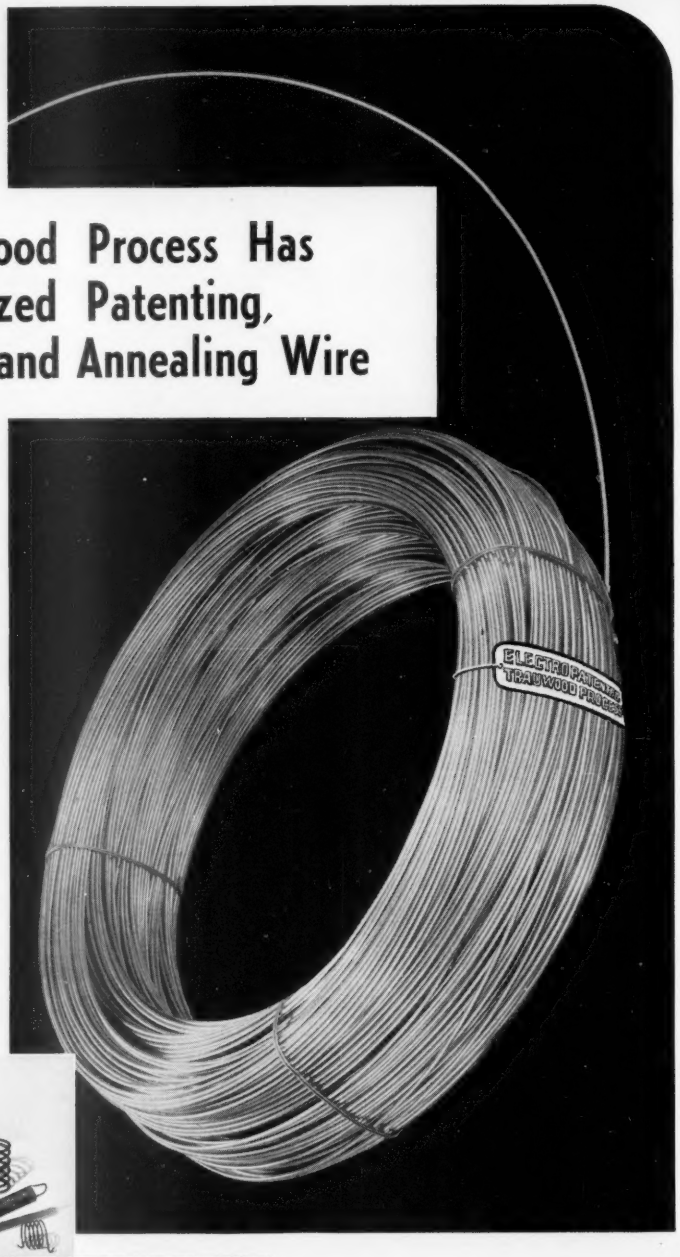
CARL-MAYER

A FEW CARL-MAYER CUSTOMERS

Allegheny Ludlum Steel Co.
Aluminum Co. of America
Atlantic Wire Co.
Atlas Steel Co.
American Magnesium Corp.
Bridgeport Brass Co.
Eclipse Aviation Division of Bendix Aviation Corp.
Ford Motor Co.
General Motors Corp.
Hollup Corporation
Hyatt Roller Bearing Co.
Johnson & Nephew, Ltd.
Page Steel & Wire Co.
Pittsburgh Tool Steel Wire Co.
Reliance Manufacturing Co.
Steel Co. of Canada
Timken Roller Bearing Co.
Thompson Products Co.
Weatherhead Co.
Wickwire Spencer Steel Co.

There's No Question About It

The Trauwood Process Has Revolutionized Patenting, Tempering, and Annealing Wire



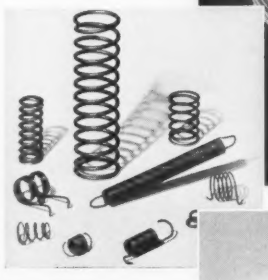
The Trauwood Process is not dependent upon the human equation. It automatically and continuously patents, tempers or anneals wire and strip by a remarkable new Electric Direct Resistance Method.

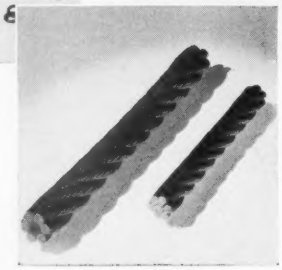
The Trauwood Process is being used by a number of the largest manufacturers of heat treated wire in the United States. It has sped up and vastly improved their output. It produces at all times wire that is absolutely uniform, with the highest possible physical and fatigue properties.

The Trauwood Process is doing its share to help speed the war effort by supplying better heat treated wire — faster and more economically.

OUTSTANDING ADVANTAGES

Much faster production . . . . No decarburization or scale . . . . Fully automatic — human equation eliminated . . . . Easy to operate . . . . Control of heating and cooling cycles extremely accurate . . . . Low cost operation . . . . High thermal efficiency . . . . Uniform physical and fatigue properties.





Trauwood

Our Engineering staff will be glad to cooperate with you. Further information will be sent upon request.

THE TRAUWOOD ENGINEERING COMPANY

1740 E. 23rd Street **Cleveland, Ohio**

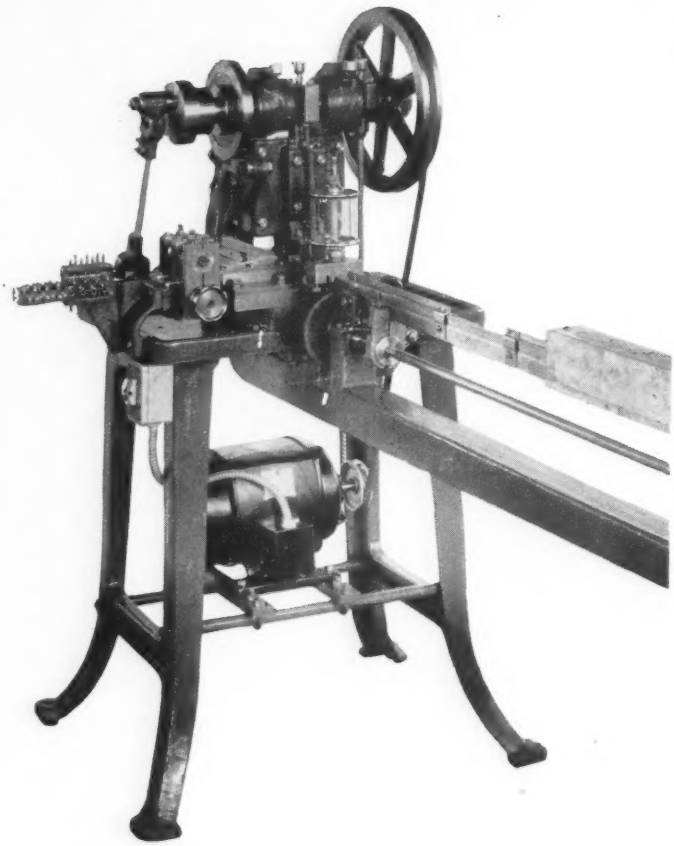
INTO
THE HANDS OF
FIGHTING MEN

J&L MEN
ARE PUTTING MORE
AND BETTER
FIGHTING STEELS
24 HOURS EVERY DAY
7 DAYS A WEEK

JONES & LAUGHLIN STEEL CORPORATION
PITTSBURGH, PENNSYLVANIA
CONTROLLED QUALITY STEEL FOR WAR

J&L STEEL

NILSON *Automatic* WI



STAPLE FORMING MACHINE NO. 1

This improved automatic staple machine takes the wire directly from the coil, straightens it, cuts off and forms staples at a high rate of speed. Adhesive is applied close to the forming tools and staples travel along the guideway through an electric heater for quick drying. The length of strip or number of staples to the finished piece is controlled by a counting and cut-off device. Length of feed is adjustable to accommodate different sizes of staples. A special attachment is required for chisel-point staples.

SPECIFICATIONS

Production	**375 Staples per Minute**
Approximate Net Weight	**600 lbs.**
Approximate Gross Weight	**725 lbs.**
Floor space (without wire reel)	**24″ x 72″**
Box Size for Export	**35″ x 36″ x 48″ high**

Nilson Automatic Staple Forming Machines have proven very practical and durable. Over a period of years they have built a fine record for trouble-free operation. Years of special machine design experience were in back of the first model, and it met quick success. Since then several improvements have been added when experiment and test proved them practical. Today these machines give you the best in low production cost equipment for the manufacture of staples.

THE A. H. NILSON

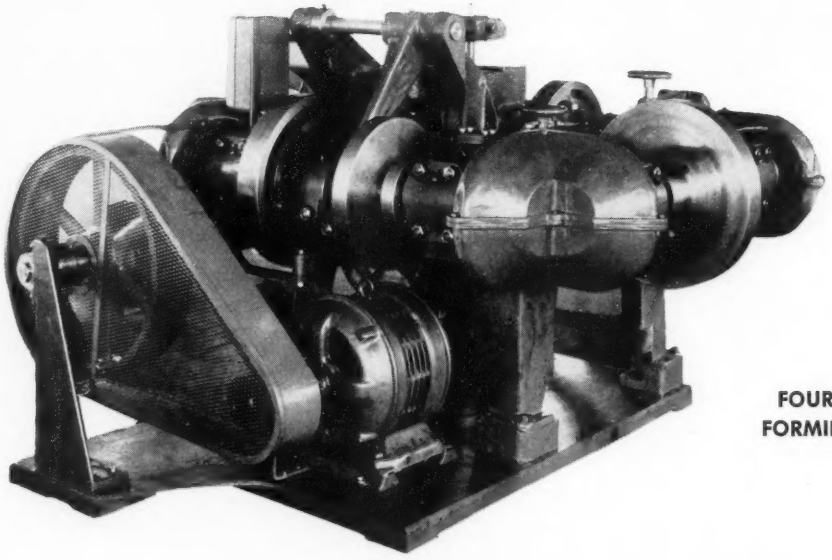
BRIDGEPORT

Builders of Special Machinery

RE *Forming* MACHINERY

THE IMPROVED NILSON STANDARD FOUR-SLIDE WIRE FORMING MACHINERY

Nilson machines, made in a wide range of models, are the result of continuous improvement. Are efficient and practical, and designed for the rapid production of a great variety of products.



FOUR-SLIDE WIRE FORMING MACHINE

Wire forming operations of Nilson Four-Slide machines cover such products as paper clips, buckles, coat and hat hooks, cable rings, screw eyes, staples, cotter pins, package handles, egg-beater blades and numerous other articles of complex shapes. Wire may be round or flat and forming is done direct from coiled stock.

Special features include four forming slides of equal length, wire feed that is silent and frictionless, return motion of cut-off tool actuated by cam, special lubricating system for cam-roll studs, wire feed operated in straight line from crank disc and an improved wire-former bracket. Nilson machines take the wire directly from the coil, ***straighten,*** feed ***cut-off*** and ***form,*** in one continuous operation.

The wire feed is positive and simple, and does not depend on friction for its action. The gripping members are actuated by an independent motion which assures the same positive pull and tension on both long or short lengths of wire. The power operating the feed is applied in a straight line from the crank disc—an exclusive feature of the Nilson machine.

Accessories include a form lifter and press attachment, and a secondary cut-off can be furnished to any size machine without drilling extra holes.

N MACHINE COMPANY

CONN., U. S. A.

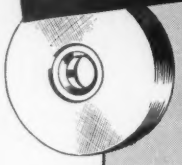
For Over Fifty Years

1 *Large* TONNAGE TO CLOSE TOLERANCE

2 *Minimum* FRICTION AND DIE WEAR

3 *Smooth* FINISH FREE OF SCORE MARKS

Vascoloy RAMET



These are the highlights in the performance of Vascoloy-Ramet Tantalum-Tungsten Carbide Dies. These too, are the reasons for converting to such dies wherever high performance must be counted on for uninterrupted day-in-and-day-out production.

Tantalum-Tungsten Carbide Dies are now used for countless forming, nosing, drawing, cupping, and extruding operations on articles of war materiel. Our special die department offers its services and experience to manufacturers making products requiring these operations.

Tell us your problems. If carbide dies can be used to advantage, we will design and produce Tantalum-Tungsten Carbide Dies that will assure you the ultimate in performance.

TANTALUM-TUNGSTEN CARBIDE DIES *for*

DRAWING

For drawing fine wire, heavy wire, special shapes, tubing, etc. For shell and cartridge cases from the blank to completed case.

COLD HEADING

Rivets and any number of small upset parts required in large quantities to close tolerance.

COLD NOSING

Artillery shells.

EXTRUDING

For extruding operations on a wide variety of parts because of quantity and tolerance requirements.

Ramet

VASCOLOY-RAMET CORPORATION

NORTH CHICAGO, ILLINOIS

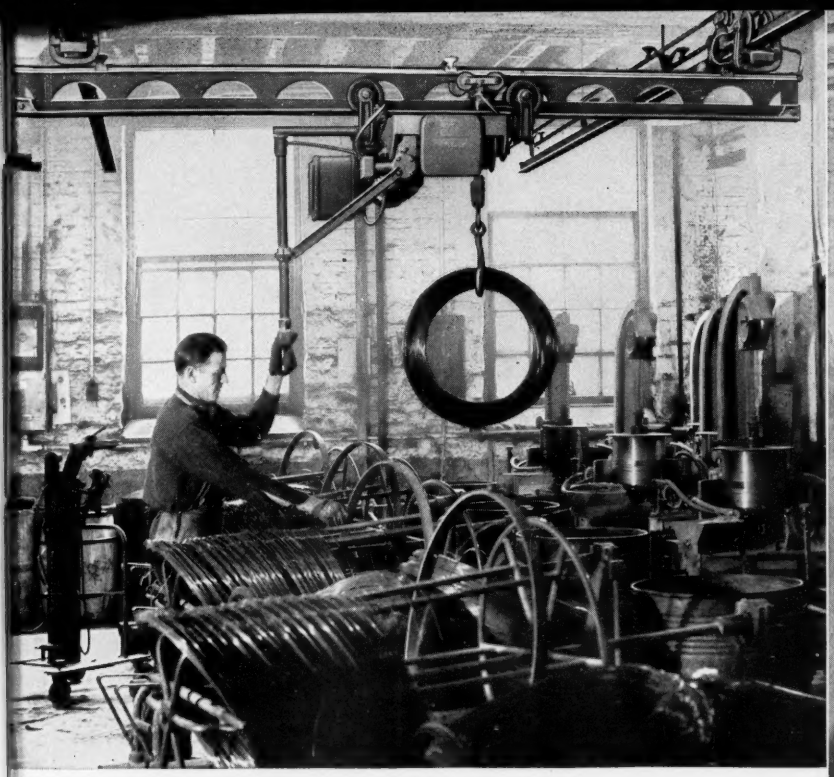
DISTRICT SALES AND SERVICE IN PRINCIPAL CITIES

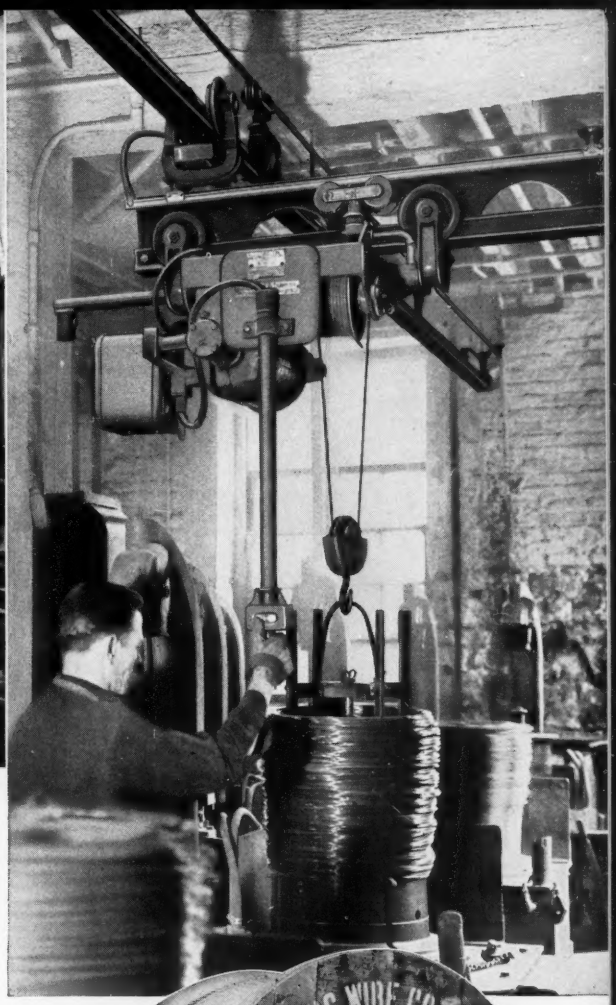
IN CANADA: Carbide Tool & Die Company, Ltd., Hamilton, Ont.

4263

TANTALUM-TUNGSTEN CARBIDE

FOR HIGH PERFORMANCE . . . *Specify* Vascoloy RAMET DIES





FASTER - SAFER

Wire Handling and Stripping

at The B. GREENING WIRE CO., LTD.

Installations of Cleveland Tramrail overhead materials handling equipment do not have to be large to be of importance. It is just as necessary to speed production, cut costs and improve safety in small plants as in large ones.

At The B. Greening Wire Co., Limited, Hamilton, Ontario, an installation of only two short-span cranes operating on separate adjacent runways is providing this progressive company with the many advantages of Cleveland Tramrail. One crane lifts bundles of wire off of storage trucks onto the creels for the four continuous wire-drawing blocks. The other crane is used for stripping the fine steel wire from the blocks. The cranes are hand-propelled with push-button operated electric hoists.

Many wire and rod plants, large and small, in the United States and Canada are being served by Cleveland Tramrail.

CLEVELAND TRAMRAIL DIVISION
THE CLEVELAND CRANE & ENGINEERING CO.
1141 EAST 283RD ST. WICKLIFFE, OHIO.

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BOOKLET No. 2008 . . Packed with valuable information. Profusely illustrated. Write for free copy on your company letterhead.

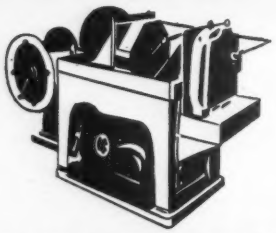
MANUFACTURERS OF • CLEVELAND CRANES • CLEVELAND TRAMRAIL • STEELWELD BENDING PRESSE

CLEVELAND TRAMRAIL

OVERHEAD MATERIALS HANDLING EQUIPMENT

Specify STANDARD MACHINERY CO.

METAL FORMING EQUIPMENT

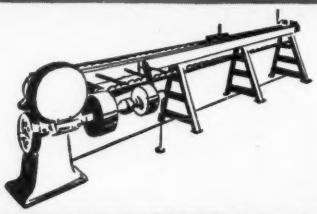


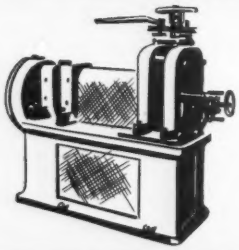
TURKS HEADS ADJUSTABLE DRAWPLATES

Adjustable draw plates—accepted by wire trade as accurate, efficient means of producing rectangular and special shapes. With friction or power driven rolls. Catalog TH.

DRAW BENCHES ONE MAN TYPE

8 sizes, 2 general types. Machines are of one-man type with all controls at die end. Catalog DB.



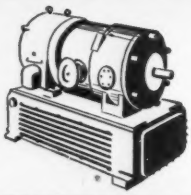


ROLLING MILLS STRIP AND WIRE

Roller bearing and plain bearing mills; many regular sizes or made to suit user's specific needs. Write fully.

SWAGING MACHINES ROTARY TYPE

For reducing diameter of tubular and solid bar stock into cylindrical, conical, or "necked" shapes. Capacities from ½" tube, ¼" solid to 6" tube or 3¾" solid. Catalog SM.



AND THE NEW *STANDARD FLUID DRIVE*

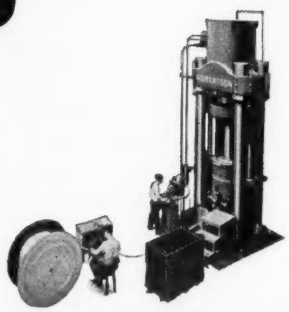
Suitable for variable speed or controlled torque drive applications. Also suitable for high pressure pumping of fluids.

Write for Complete Information

STANDARD MACHINERY CO.

PROVIDENCE RHODE ISLAND

Used by *nearly all* manufacturers of Lead Encased Cable in the United States and Canada



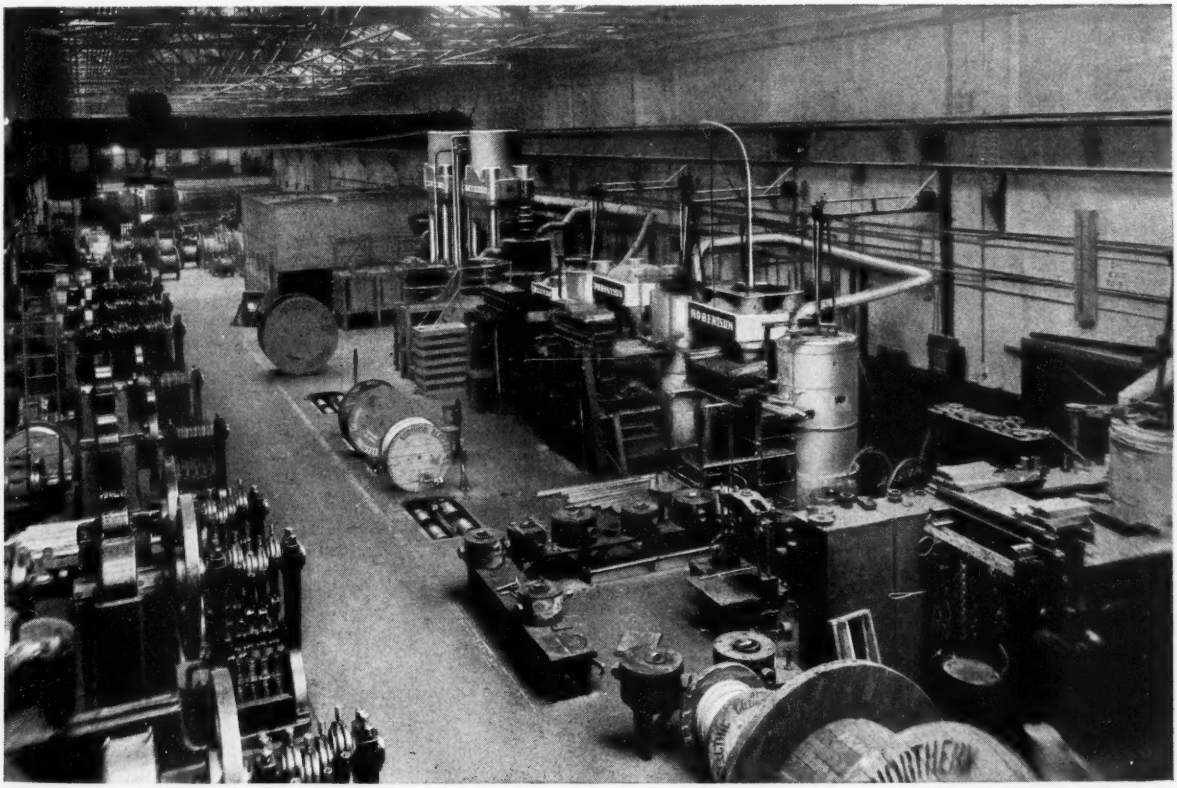
JOHN ROBERTSON COMPANY, INC.

125-37 Water Street, Brooklyn, N. Y.

ESTABLISHED 1858 ● Designers and builders of all types of lead encasing machinery for electrical cable and rubber hose manufacturers; including extrusion presses, hydraulic pumps, melting furnaces and pots, hydro-pneumatic accumulators, lead sheath stripping machines, and dies and cores.

Testimonial to your judgment in having selected ROBERTSON Equipment for your plant is the concurring decision by the vast majority of all other leading producers of lead encased cables.

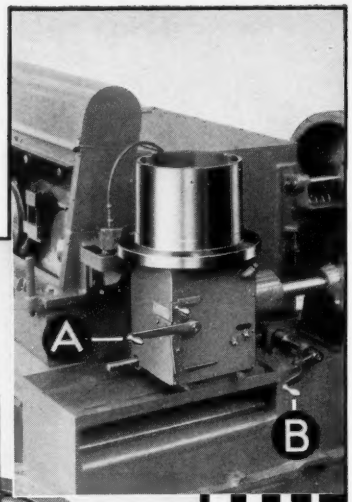
These old customers consistently have reordered ROBERTSON machines, as expanding needs have required . . . and, therein is the best proof and highest praise of quality and performance that any products could have.

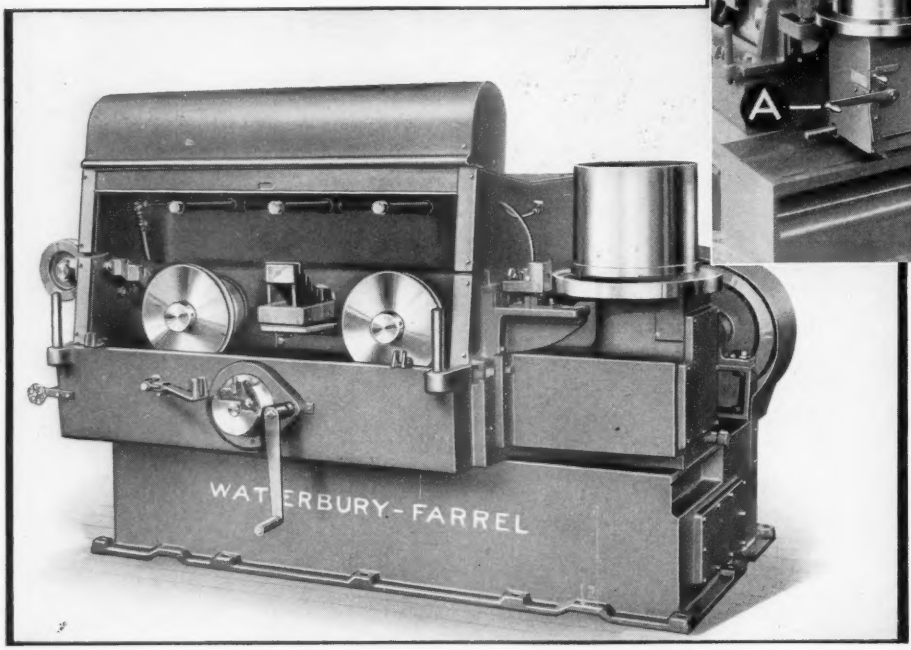


If it's a question about the design, maintenance, repair, or conversion of

Cable Lead Encasing Equipment—ask **ROBERTSON**

WIRE DRAWING MACHINES





FOUNDED WATERBURY FARREL 1851

by WATERBURY-FARREL

WITH WIRE BLOCKS WHICH *rotate in either direction*

Upright Cone Continuous Machines with provision for quickly changing the rotation and position of block.
Two conveniently located removable handles do the trick in jig time—

A — changes direction of rotation
B — shifts position of block - - -

The machines are available with blocks of various diameters or with spooling devices. Our wire drawing machinery is described in Catalog W.

• WIRE AND ROD MACHINERY • COLD HEADING MACHINERY, ETC. •

WATERBURY FARREL
FOUNDRY & MACHINE COMPANY
WATERBURY • CONNECTICUT • U·S·A

CHICAGO CLEVELAND NEWARK, N. J.

WIRE AND WIRE PRODUCTS

A monthly publication devoted to the production of Wire, Rod and Strip, Wire and Rod Products and Insulated Wire and Cable

DRAWING — ROLLING — EXTRUDING — FORMING — FABRICATING

Vol. 18 JANUARY, 1943 No. 1

Designated as

Official Publication By The Wire Association

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— ASSOCIATE EDITORS —

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Lancaster, Allwine & Rommel, Consultants on Patent Information

Richard E. Brown, General Manager
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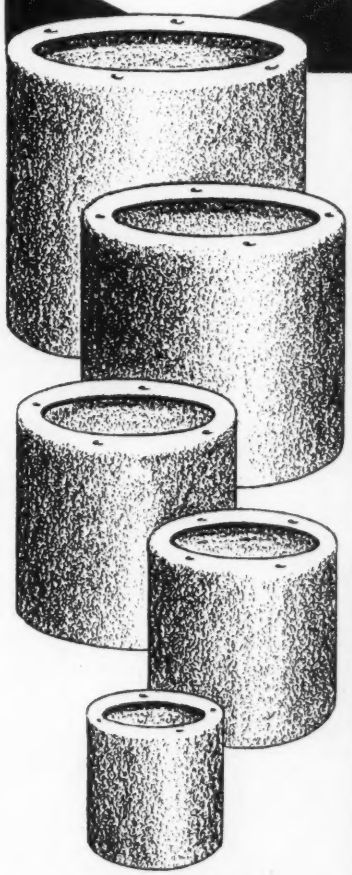

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DRAWING --- ROLLING --- EXTRUDING --- FORMING --- FABRICATING

Vol. 18 JANUARY, 1943 No. 1

Steel and Wire

By Louis H. Winkler,
Metallurgical Engineer,
Bethlehem Steel Company, Bethlehem, Pa.

THE MORDICA MEMORIAL LECTURE
— 1942 —

The product of wire mills covers a field that is much more diversified than is generally realized. The purpose of this review is to indicate the development in the manufacture and application of steel wire and to emphasize the close relationship that should exist between the steel plant and the wire mill. ✦

Introduction

WE are told that wire was produced in the Middle Ages when its most important use was in the manufacture of chain armor for fighting men. Naturally that product of centuries ago would not compare in quality or diversity with the product of a modern wire mill. But the artisans of that day displayed ingenuity and courage in overcoming the handicaps imposed by the inadequate and crude equipment available to them. The development of dies to withstand the high pressures of even the relatively soft materials drawn at that time, the fashioning of machines to draw the materials through the dies, and even the preparation of the metal for drawing, must have presented almost insurmountable difficulties.

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AS time went on, better materials were devised from which to make the dies, the design and contour of the dies were greatly improved, better mechanical equipment was designed, and from a humble beginning a great industry has grown. Early in the industry, only soft steel or iron wire was drawn. Later developments in dies and machinery made it possible to draw into wire a full range of steel from very low carbon to very high carbon. During these early periods of progress, much depended upon the skill and resourcefulness of the men who did the work. Wire drawing was distinctly an art.

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WITH the introduction of higher carbon steels, new problems were encountered which resulted in the discovery of preparatory and intermediate heat-treating procedures such as annealing and patenting, the development of better cleaning-house practice and the improvement in wire-drawing lubricants. Consequently, we now have what may be considered a greater diversity in wire than is found in any other steel product, beginning with soft wire of about 45,000 pounds per square inch tensile strength and extending to wire of high-carbon steel with a tensile strength of considerably over 300,000 pounds per square inch—all without the assistance of any special alloying elements in the steel composition. This broad range in grades and qualities is accomplished and controlled by steel quality and composition, preparatory heat-treatment and cold-work. The range in physical properties and special characteristics in steel wire may be further augmented by employing final heat-treatments, such as are used in making hardened and tempered

Designated as Official Publication by the Wire Association

IN MEMORIAM

JOHN MORDICA
1873 - 1937

It is a privilege to join in paying tribute to one of the great men of the Wire Industry, to a man who had much to do with the starting and with the successful growth of the Wire Association, to the one for whom the lecture gets its name, Mr. John Mordica.

Mr. Mordica came to Sparrows Point in 1925 for the purpose of operating the Rod and Wire Mill then under construction. His skill and ability as a wire man, gained through a vast experience during his life time, manifested itself not only in the building of that mill but in the years he served as its operating Superintendent, which position he held until his death.

It was my good fortune to be associated with Mr. Mordica during this period. I worked with him for 12 years. Never have I worked with a man more fair, more helpful and I appreciate this opportunity to pay a tribute to the man who made possible for me an education I could have obtained in no other way.

In recognition of the efforts expended on behalf of the Wire Association and for his contribution to the Wire Industry, the Wire Association, in order to perpetuate his name, voted in 1938 to establish the Mordica Memorial Lecture.

The author of this year's lecture, Louis Winkler, was one of Mr. Mordica's closest friends. Acting as Metallurgical adviser, his assistance has been invaluable, especially during the early days of the Wire Mill. He has worked with steel during the past 33 years and there is no one better qualified to speak on the subject "Steel and Wire" than he.

After receiving degrees in metallurgy and mechanical engineering at the University of Missouri in 1909 he came to Cambria and served successfully as Metallurgist and Engineer of Tests, until 1928. Since then he has been located in Bethlehem in the capacity of Metallurgical Engineer.

C E Johnson

President, The Wire Association

spring wire of a wide variety in both plain carbon and alloy steels. The list of wire products is so manifold that it is not surprising to find a large number of manufacturers who restrict their production to definite specialties.

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MUCH of the early history of wire is part of the industrial history of New England, and we must extend much credit to those early New Englanders whose enterprise, ingenuity, and craftsmanship led the way.

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OF late years we have been impressed with scientific developments and the part they have played in providing new materials and methods in the production of commodities so essential to modern civilization. In giving science proper acknowledgment we may, to some extent, have been unmindful of a concurrent progress in engineering skill and individual craftsmanship. Perhaps, therefore, we may be permitted to emphasize craftsmanship in this discussion. Not only skill, but careful control of details, is an important element of craftsmanship and science alike. Science has contributed much by providing new and improved instruments for observation and control and by accumulating a stock of fundamental knowledge. Yet just as in the research laboratory the scientist becomes his own engineer and technician, so in industry the engineer and craftsman have been essential in reducing scientific discoveries to practice. All have labored hand in hand.

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WHILE the important developments in wire-drawing equipment already referred to were taking place, great progress was also made in manufacturing, and in improving the quality of the metal to be drawn. Each year more attention was directed toward the perfection of steel that would best survive the severe drawing stresses and lend itself best to plastic flow. Improvements in both facilities and steel stimulated demands for improved quality in wire and broadened its field of usefulness. While the advances in wire-making facilities were easily recognized as they progressed, the equally important improvements in the steel were not so obvious. The steel industry, during the period, provided enormous capital investment in mills and other equipment for the manufacture of high-quality steel rods.

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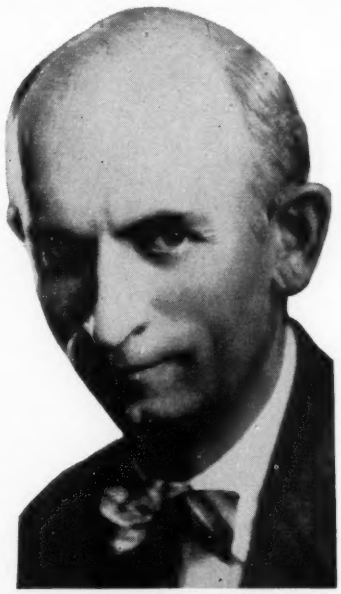
MUCH of this progress was made possible by the development of closer cooperation and better understanding between the men who made the steel and those who drew the wire. If there is not freedom in the interchange of knowledge and ideas, progress is slow and difficult. If we give thought to the very extensive and diversified services that all these different kinds of wire must perform in today's engineering uses, the need for even closer cooperation and understanding between the men in all related fields is obvious. It is too much to expect one man to possess all the knowledge or experience necessary to do the job better. The progress of the future will more largely depend upon how far we continue to go in understanding each others' problems and on the freedom with which we exchange our knowledge and experience. The steel-maker and the wire-drawer must take each into the other's confidence and each must learn to know something of the other's business and problems.



LOUIS H. WINKLER

University of Missouri, B.S. in M.E., 1907. University of Missouri, Mechanical Engineer 1909. Engineering Department, Cambria Steel Company at Johnstown, Pennsylvania, 1907-1909. Metallurgical Department, Cambria Steel Company, 1909-1917. Engineer of Tests, Cambria Steel Company, 1917-1928. (The Cambria Steel Company was purchased by the Bethlehem Steel Company in 1923). Metallurgical Engineer, Bethlehem Steel Company at Bethlehem, Pennsylvania, 1929-19--. Member of the Wire Association, American Petroleum Institute, Iron and Steel Institute (Great Britain), American Society for Testing Materials, American Society for Metals, American Iron & Steel Institute and American Institute of Mining and Metallurgical Engineers.

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NO stretch of imagination is required to picture the many factors and problems presented in transforming a quantity of unimpressive iron-bearing earth into coils of very fine-gauge, high-quality wire. But many who produce wire have little conception of the effort and enterprise that have been expended in making the needed grade and quality of rod to produce the desired finished product. It is hoped that the following brief review of steel-making will stimulate a desire on the part of wire-mill men to learn more of this fascinating science and art.

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Transformation of Ore Into Steel

IN ancient times malleable metal was produced by the direct reduction of iron ore in a crudely-constructed forge, employing charcoal as fuel. Through the centuries as progress was made in the art of iron-smelting, the blast furnace was developed. The product of the blast furnace, however, as cast from the molten state, is not malleable; supplementary operations had to be evolved to make it so. The puddling process for making wrought iron and the Bessemer and open-hearth steel-making processes followed.

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YOU are all more or less familiar with the modern blast furnace, which easily produces a thousand tons of pig iron in a day. Vast facilities are required to provide a constant flow of carefully selected ores, specially prepared fuel, and limestone as a flux, to feed the furnace. Large turbo blowers to furnish the enormous amount of air blown into the furnace at the rate of about four and one-half tons of air per ton of

pig iron, stoves for preheating the blast, electric-generating equipment to furnish power for the equipment serving the furnace with approximately three and one-half tons of solid charge per ton of iron, and many scientific instruments as an aid to the control of the operation, are all essential adjuncts. Scientific research and engineering development have contributed greatly to the progress in modern furnace design and operation, but of like importance is the craftsmanship required of the plant personnel upon whose skillful attention to innumerable details a most "temperamental" operation depends.

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THE manufacture of steel begins in the blast furnace, with a product known as pig iron. The excellence of the product of subsequent processes depends much more than is often realized upon the grade and quality of pig iron supplied to the steel-making units. Starting with a well-designed furnace, serviced by adequate equipment, the grade and quality of the iron can be assured by critical selection of the material entering into the charge, careful control of slag, and close regulation of the temperature in the hearth and reducing zones of the furnace.

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CLOSE contact and co-operation between the steel-making department and blast-furnace department are essential in order that adjustments in furnace burdens and furnace operation may be made to meet the requirements for definite qualities of iron needed in the making of specified steels, whether special wire-steel grades or steels for other end uses.

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AT the high temperature in smelting, molten iron takes up carbon, silicon, manganese, sulphur and phosphorus from the fuel and ore burden. Since this results in a product that is not malleable, in order to make steel, pig iron must be refined by one of the steel-making processes. The choice of process depends upon the characteristics desired in the steel. Each process appears to have its own particular merit and in some cases the product of one process is better adaptable to a given application than another.

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IN a sense, the steel-refining processes are the reverse of the blast-furnace process, inasmuch as the excess carbon, silicon and manganese are removed by oxidation, while the blast furnace's reactions are primarily reducing. In the Bessemer process these elements are eliminated by blowing cold air through a molten bath of pig iron. In the open-hearth process the excess metals and metalloids are removed by the oxidizing action of the furnace gases and slag, sometimes assisted by ore additions.

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THE product of combustion of carbon is gaseous and passes out of the furnace, but the products of combustion of silicon and manganese are solid and, together with iron oxide, help to make up the slag. As in the blast furnace, the slag character is of utmost importance. Slag control, together with control of the temperature, has the most profound influence upon the final results. Therefore, a great deal depends upon the skill and knowledge employed by the melters in making and shaping up the slag during the various phases of the refining operation. In fact, the quality of the finished steel depends largely upon the slag-temperature history of a heat.

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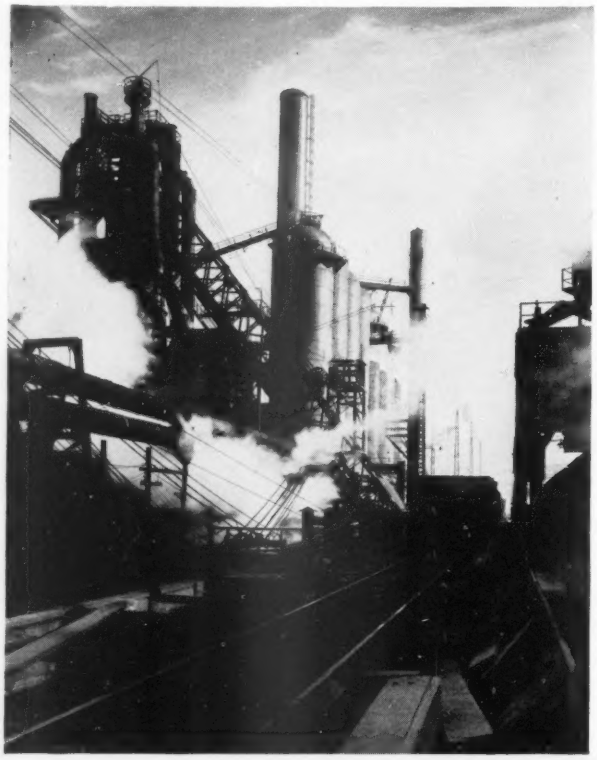
THE furnaces employed in the manufacture of steel must be lined with a refractory material, the melting point of which is much higher than the metal bath and the strength of which, with its supporting structure, must be sufficient to withstand the high ferrostatic pressures and normal erosion and fluxing that occur during the refining of the metal. For this service two types of refractory earth are available. One type is characterized as acid in nature at these high temperatures, and the other is basic. The individual processes, acid and basic, take their name from the character of the furnace lining. Acid linings are siliceous; basic linings are either oxide of magnesium or the double oxide of magnesium and calcium, and sometimes a neutral substance such as chrome ore is used. Since an acid slag would attack a basic furnace lining, it is necessary to use an acid slag process in an acid-lined furnace, and a basic slag process in a basic-lined furnace. The acid slag is essentially a double silicate of iron and manganese with silica predominating; the basic slag consists principally of calcium compounds and iron and manganese oxides.



Blast furnace where ore is converted into iron, the first step in steel making.

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STEEL in almost countless varieties of grade and qualities is used in

the manufacture of wire. This is because of the vast number of applications to which wire is adapted, and the varying nature of each individual set of requirements that must be met. Each quality, therefore, requires in its manufacture and processing through the mill an entirely distinct and closely-controlled practice especially designed as the result of the experience gained in the development of each individual quality and grade. The term "quality" is by no means easily defined, nor does it follow that because a given procedure results in superior quality for one given application that the same procedure will result in a proper quality for another application of different character. This has long been recognized in the manufacture of hot-rolled steel and, manifestly, it is true also of wire, to which we find added to the problems of the manufacture of hot-rolled or forged steel, the factors introduced by cold work. The skill and care employed in the manufacture of steel probably find their principal reflection in the quality of the wire. The factor of "quality" begins with the initial steel-making charge, continues through the entire history of the heat in the steel-making unit, and is influenced by the degree of refinement and intermediate preparations observed in converting ingots into finished rods. The other factor in this combination of "grade" and "quality" is more easily determined. It may be expressed in terms of chemical analysis or physical properties.

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TO illustrate the difference between the two terms, "grade" and "quality", we might take examples from plate steel. In plate steel of approximately 0.20 per cent carbon, there are available several qualities such as tank plate, structural plate, and firebox plate, each "quality" being dependent upon the degree of refinement—and consequent cost — involved in the manufacture of the steel and its subsequent processing through the mills, even though each of these several "qualities" might be of the same "grade" as measured by either analysis or tensile strength.

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WITHOUT entering too far into a discussion of the relative merits of each of the principal steel-making processes, except to say that the product of each may have its own special fields, there is an interesting economic phase that may be reviewed briefly. Since the oxide of phosphorus formed during the steel-making operation cannot be retained in an acid slag, phosphorus cannot be removed from metal being refined by an acid process. Therefore, in selecting the material and making up the charge for an acid furnace, the phosphorus content of each item must be taken into account, because all of that element which enters the furnace will be present in the finished steel. A relatively small proportion of our ores lend themselves to the manufacture of acid steel. In the basic open-hearth practice, the acid oxide of phosphorus combines with the lime of the slag. Once incorporated as phosphate of lime in the slag, the phosphorus is easily held there; which is to say, it does not readily revert to the metal. In this way we can make steel low in phosphorus even from ores relatively high in phosphorus. We have large deposits of such ores adaptable to basic steel manufacture, and since important advances have been made in the manufacture of steel, there no longer exists the wide gap in quality between acid and basic steels that existed a few generations ago. Fortunately, both kinds of steel are available in adequate quantities for the uses to which each may be especially adapted.

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AT one time, we heard it said on all sides that the manufacture of Bessemer steel would shortly be discontinued. It is doubtful that this will ever occur, because acid Bessemer steel does possess certain characteristics which are peculiar to steel made by that process and which differentiate it from open-hearth steel. These characteristics lead to its preference for a number of specialized applications, and in the wire industry we would be definitely conscious of its absence were it no longer available. There are a number of special-purpose wires for which no wholly satisfactory open-hearth substitute for Bessemer has been developed. Moreover, the Bessemer process will continue to be a factor from economic considerations even though the ores adaptable to that acid steel-making process are not so plentiful in this country as the ores available for the manufacture of basic open hearth steel.

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IT may be of interest to discuss briefly the physical chemistry of steel-making, for which purpose we select a heat of basic steel as an example.

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IN making quality steel, it is conventional good practice to make up the metallic portion of the charge of selected steel-melting scrap and pig iron in such proportions that enough silicon and manganese are provided to form a proper slag, and enough carbon is in the bath after it is completely melted to ensure proper refining of the metal. Limestone is also included in the charge, usually to the extent of some 8% to 10% by weight of the metallic charge. The purpose of this limestone is to provide the basic radical of the slag. Often ore is charged in an amount that experience has shown will ensure, after melting, a carbon content in the bath within the pre-established range to provide for the proper refining and finishing of the heat. The heat is usually considered to have been melted when the limestone comes up to the top for the formation of the slag; this occurs after the metallic parts of the charge have become entirely molten.

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IN tne early part of the heat, the boil is quite violent but after approximately one-half hour it subsides to a quiet regularity. The oxidization of carbon, silicon, manganese, phosphorus, and iron from the charge progresses from the very beginning of the melting process. The oxidization of the carbon forms a gas and produces the

boiling agitation; the oxidization of the manganese and silicon result in solid compounds which, together with oxide of iron, join the lime to form the very important slag, covering the bath of the molten metal. The oxidizing action is carried forward by the flame either with or without the assistance of iron-ore additions.

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THE oxides of iron and manganese confer fluidity to the lime-silica slag and act principally as bases with the lime to satisfy the acidity of the silica. As already stated, the acid oxide of phosphorus combines with lime and enters the slag. There being more iron than other elements present in the metallic charge, the amount of iron oxidized during the process would be excessive were it not for the reducing action of the carbon in the bath. This reducing action is so strong that the amount of iron oxide contained by the slag tends to be continually held down to the amount necessary to contribute fluidity to the slag under the temperature and the bath condition existing at the time. When manganese oxide is present in the slag in sufficient quantity, its effectiveness in acting toward conferring fluidity to the slag makes it possible to employ slags of higher basicity. In this manner manganese becomes a help in the control of sulphur. However, a basic open-hearth slag is much more efficient in removing phosphorus from the metal than in removing sulphur.

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AS indicated in the foregoing, there are definite forces which automatically operate in the direction of keeping all of these reactions in balance, and this adjusting tendency on the part of the slag through its ability and its disposition to take on a composition which will confer fluidity, together with the forces which will tend toward the establishment of equilibrium between the oxidizing actions and the reducing actions, constitute one of the most interesting phenomena in chemical reactions at high temperature. This slag, which you remember is principally a complex of lime compounds, is the refining agent in the metallurgical process, and the agitation produced by gases released through the oxidation of carbon brings every particle of the metallic bath rapidly and completely into contact with this refining slag. The flexibility of the slag and its tendency automatically to find its correct constitution for every period of the refining phase in the heat makes the slag an important ally of man in his efforts to make high-quality steel.

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DURING the finishing stage of the refining period of a heat, oxidization is carried on only through the agency of the slag. It is, therefore, apparent that slag control becomes very important in any metallurgical operation. The old-time steel-maker knew through practical training and experience the importance of controlling the slag and temperature during the various stages of the heat. In more recent years his practical knowledge has been supplemented by results of scientific investigation which have broadened our fundamental knowledge and understanding of these phenomena. The work of the physical chemist has been of great assistance in the improvement of steel quality, but skill and craftsmanship on the part of the open-hearth organization remain of utmost importance.

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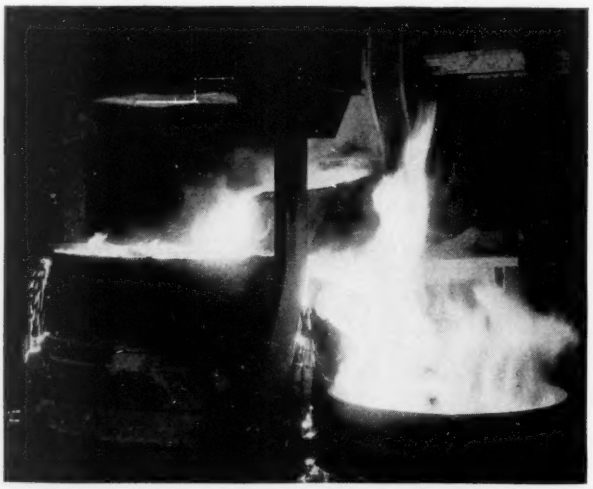
DURING the working of a heat of steel, the melter and his crew have many items to watch, other than those just enumerated. Since the proper relationship of the bath and slag depend upon the bath condition, as well as the slag condition, they must follow the progress of elimination of carbon and so shape the procedure that the reactions have properly subsided by the time the heat reaches its finishing stage in order that conditions of equilibrium may be properly approached at the end of the refining period. After all of this has been accomplished, the skill of this organization again comes into play in finishing and tapping a heat on grade within re-

Charging floor of open-hearth furnaces. Melting operations are controlled from this floor. ✦ ✦ ✦ ✦ ✦



Tapping an open-hearth furnace. Ladle at left is full and slag is spilling over into the slag pot. ✦ ✦ ✦ ✦ ✦

markably close limits as to chemical composition. In recent years scientific procedure and mechanical equipment have developed to a remarkable degree. But steel-making still depends largely upon the skill, earnestness and resourcefulness of the men who devote their life and effort to this work and who find satisfaction in that work just the same as the artisans in any field.

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SILICON and manganese are important alloying elements in the final composition of steel, the amount of each obviously depending upon the type of steel required and upon its use. Both are usually employed in the form of ferro alloys as finishing additions to the heat. Besides acting as alloys, manganese and silicon also act as deoxidizers and are frequently used in the form of spiegel during the processing of a heat.

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FOR more complete deoxidation, silicon and manganese are sometimes supplemented by other more powerful deoxidizers such as aluminum. These several finishing procedures definitely influence, in varying degrees, the character of response of the steel to heat-treatment, its reaction to cold work and, therefore, that influence will often carry through to the finished product. Generally speaking, special steel-making practices should be confined to special-purpose wire commodities and the choice of practice must, therefore, be entrusted to the steel-maker. When a finished product is of the kind where special steel-making procedures might be advisable, for example, with respect to producing a controlled inherent grain size, the manufacturer of the rod should be given detailed information respecting the special qualifications desired in the finished wire and also as much information as is available regarding the manufacturing operations to which the wire will be subjected.

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IN the low-carbon ranges, steel is made in both the killed steel and rimmed steel varieties.

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STEEL which is so made that, after teeming, it lies quietly in the molds and is free of action is known as "killed steel." During the solidification of that type of steel in molds, crystallites grow inward from the cooling surfaces and as these crystallites multiply and grow, their branches intermesh and entrap liquid metal between them. These very small pools thus trapped ultimately freeze solid. This system of freezing has been called the "land-locking" system of freezing, and is similar to what all of you have observed in the freezing of pools of water. You have all noted how the "pine-tree" crystallites of ice start out from the edges of a pool of water, locking between the branches small areas of water; as the branches of these crystallites thicken and multiply, the top finally becomes a solid surface of ice. Such a system of freezing manifestly could not take place if there were any disturbance during its progress, such as might be caused, for example, by the evolution of gas from solution as the temperature of the metal in the ingot mold dropped.

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UNLESS lower-carbon steels are deoxidized, the steel may be "rimmed." Such steel does not lie quietly in the mold after pouring but boils actively because of the release of gas during solidification. The convection and disturbance caused by this effervescent action lays the newly solidified crystals back toward the wall of the ingot. The freezing thus proceeds in layers, each layer forming at progressively lower temperatures and containing progressively a slightly larger percentage of metalloids. After the freezing has proceeded far enough to form an adequate shell on the outside of the ingot the action is stopped by capping the ingot. This has been referred to as the "onion skin" type of freezing. The formation of these layers shows at the top of the ingot as a rim which thickens as solidification proceeds. It is from that appearance that this type of ingot takes the name of "rimmed" steel.

Blowing a Bessemer converter. This spectacular process is used to make certain types of steel.

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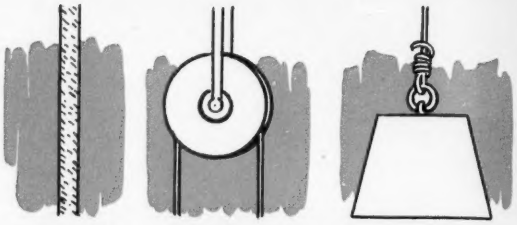
THIS phenomenon of the freezing of steel is most interesting. The first crystals to freeze are relatively free of the metalloids carbon, phosphorus, and sulphur, because the metal first to freeze has a higher solidification temperature and a lower content of these metalloids. As the temperature lowers, the concentration of these metalloids rises in the crystals which solidify at the lower temperature. Thus, in rimmed steel, each layer formed is progressively higher in carbon. The out-

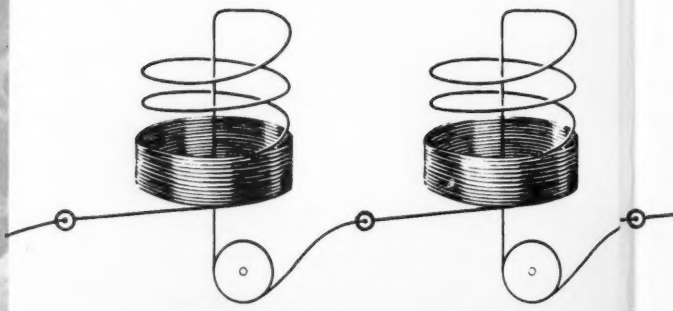
HERE ARE YOUR

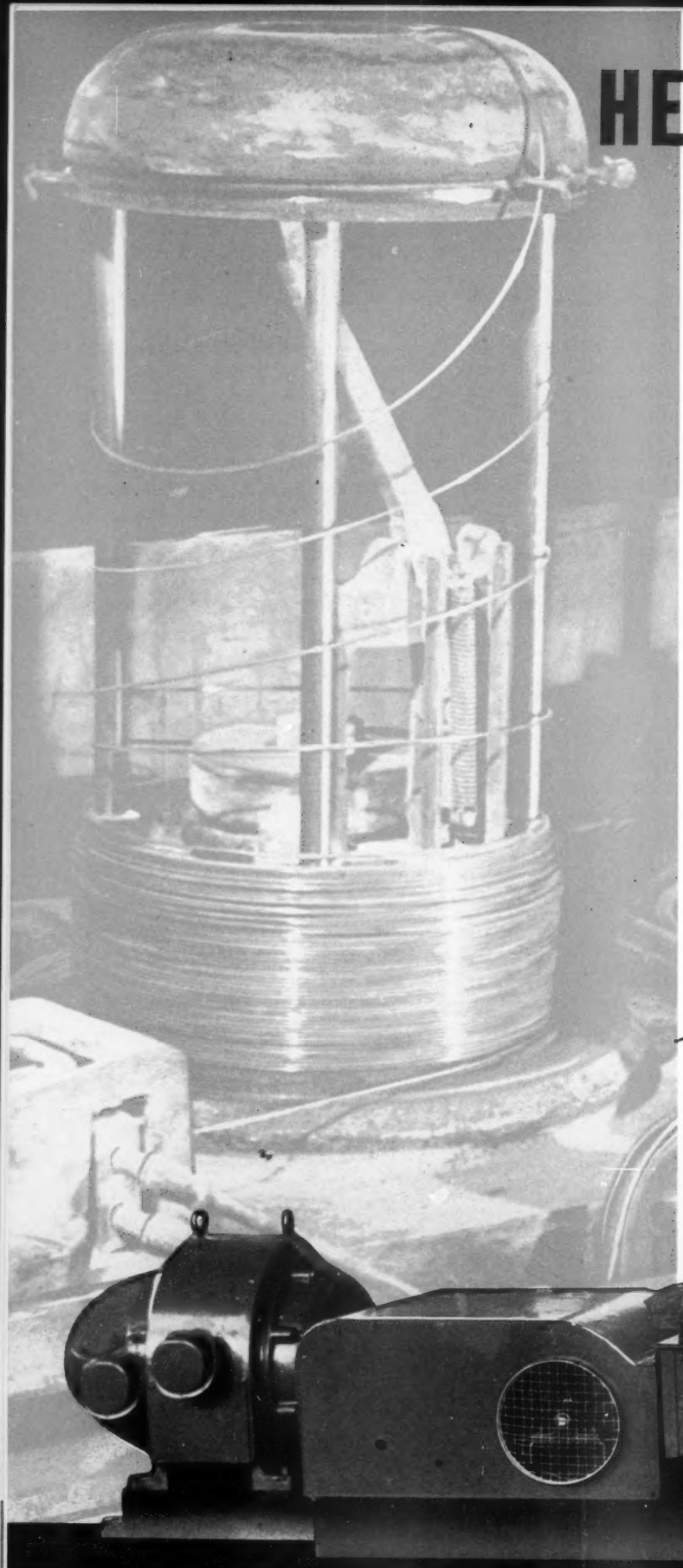


TWIST BEND TENSILE EL

Morgan-Connor Continuous Wire Drawing Machine Type BW, shown below, is one of several Morgan Multiple block machines capable of drawing high carbon or low carbon stock at high production speeds.

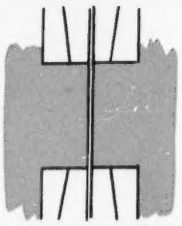
W-82





MORGAN WIRE DRA

Wire Rope STANDARDS



ELONGATION

IN THE MAKING

YOU can draw to exact specifications on a Morgan Continuous Wire Drawing Machine—as exact as though each reduction were handled on a single wire block.

This is because each Morgan block is, in effect, a separate machine. Wire entering the last die is as cool as when it left the reel.

Each high block is air-cooled and provides a time interval for effective air cooling of the wire.

Yet there is no "time out" in the smooth, trouble-free production flow. Greater output, lower costs, less maintenance, smaller floor space, greater safety—these are some of the other reasons why Morgan Wire Machinery is helping America today

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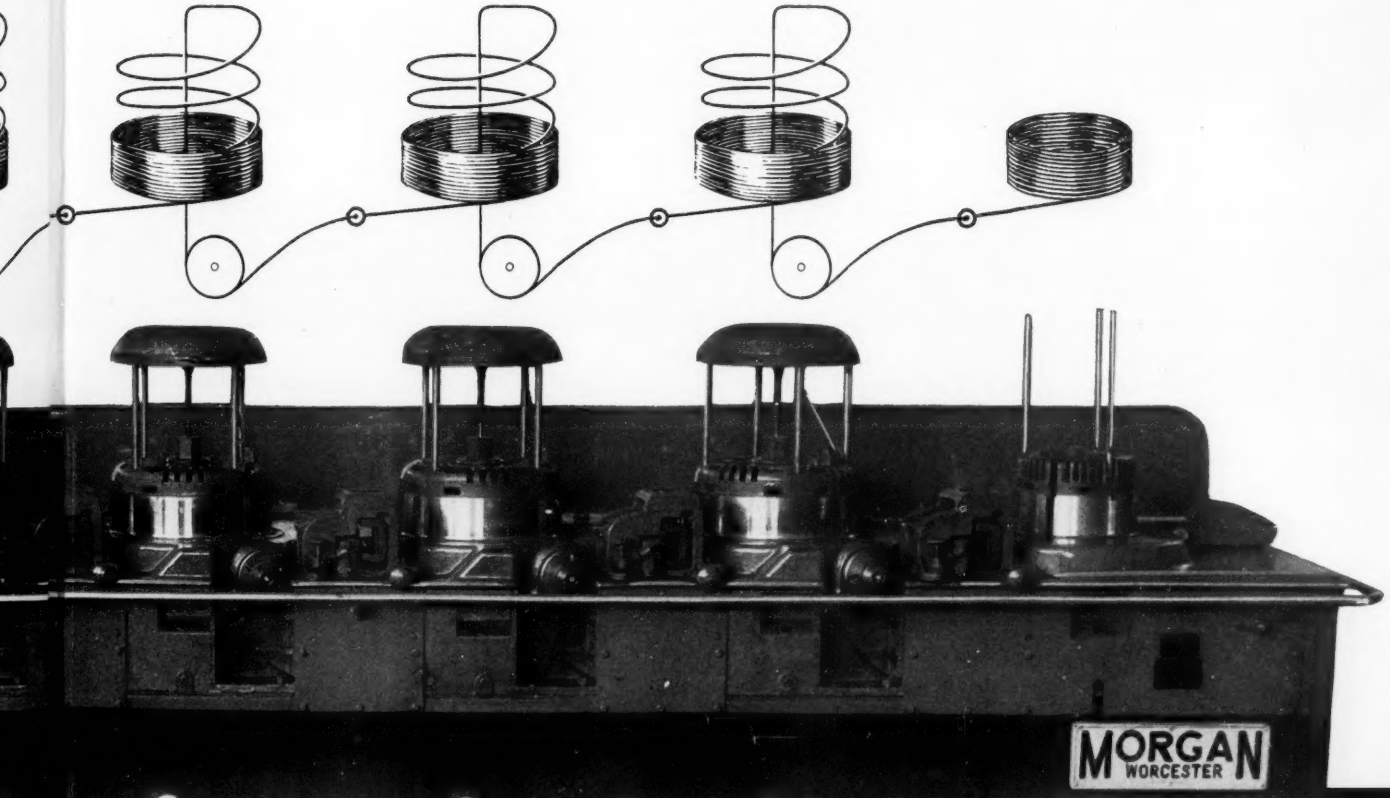

RAWING MACHINERY

side layer is almost free of carbon while the carbon in the center has reached a concentration such that the average composition of the entire cross-section would be equivalent to the carbon content reported for the steel. Obviously, therefore, in rimmed steel considerable segregation occurs. However, by recognizing this to be the case, we should not become disturbed or prejudiced by the term segregation. On the contrary, there are certain uses to which rimmed steel is definitely better suited than steel of the killed or semi-killed variety. The extreme softness and ductility of the outer layers thus become a desired attribute in cases where, for example, severe forming is involved.

✦ ✦ ✦

EVEN in killed steel, we have this phenomenon of selective freezing, the first crystals to form being relatively very low in carbon. But the fact that there are numberless interlocking branches formed throughout the cross-section of the quietly solidified ingot, which branches trap the molten metal between their interstices, prevents the extreme result of selective freezing in layers that is exhibited in rimmed steel.

✦ ✦ ✦

EACH type of steel has its own definite mechanical characteristics, and it is obvious that there may be applications where one will be preferred over another.

✦ ✦ ✦

IT is not to be inferred that an ingot of killed steel is entirely free from segregation. Remember that segregation is the result of perfectly natural forces which we can control only to a certain measure. Every little pool in the interstices between the branches of the land-locking system of freezing, freezes selectively and indeed even the microstructure of steel exhibits this same characteristic. Therefore, in spite of everything that we can do in producing killed steel, we are bound to have differentials in composition between the outside and center of an ingot and between the lower and upper portions. This will be the case until some means for instantaneously solidifying steel have been found, and in that case the steel might exhibit characteristics not always desirable. The larger the mass involved, naturally the more prominent is that differential because the period of solidification is longer. However, in spite of these natural forces, a surprising degree of homogeneity has been accomplished by observing extreme refinements of slag control, heat-finishing procedure, deoxidizing practice, ingot-mold design, and casting technique.

✦ ✦ ✦

SINCE molten steel occupies more volume than solid steel and the outer dimensions of an ingot are fixed by the early solidification of the walls, top and bottom, long before the mass as a whole has solidified, there must of necessity be formed within this ingot a void, or voids, to represent that difference in volume. The ingots are so designed that the length is several times the cross-sectional dimension, and as they are cast upright the cooling effect of the stool and the mold is such that the ingot cools and solidifies upward from the bottom and inward from the outer walls; the last portion to freeze is at the center well up toward the very top. This, therefore, determines the position of the void (or pipe, as it is called). As the last portion to freeze is naturally at the bottom of this void, the position of maximum segregation in killed steel is likewise established. When this ingot is rolled, the top portion is discarded at the shears for the purpose of eliminating the piped portion of the ingot with the accompanying highly-segregated portion. The close attention given to this feature results in surprisingly few cases of piped steel reaching the consumer.

✦ ✦ ✦

IN recent years a page has been taken from the notebook of the foundryman, and in most special steels of the killed variety the ingot molds are provided with a refractory top which when filled with molten steel furnishes a feeder head for the useful part of the ingot and establishes the pipe cavity with the harmfully segregated portion within the sink-head part of the ingot. This sink-head portion is always discarded at the blooming-mill shears.

✦ ✦ ✦

SOMETIMES there are secondary voids below the main-pipe cavity which may not be of consequence except in cases where very high quality is required. For special quality an extra amount of top discard is taken to insure against minor interior weaknesses. In these cases other special practices are also observed, in addition to special discard.

✦ ✦ ✦

IN the manufacture of those special steels in which it is necessary to observe all these refinements, such as special discards, special surface requirements, and close analysis limits and diversion of billet product, there are instances where the yield in final product from the ingot may be as low as fifty per cent.

✦ ✦ ✦

OBVIOUSLY, the degree to which the special refinements are observed in the entire process of melting, rolling, selection, and inspection govern not only the quality of the product but the cost as well. Therefore, perhaps one of the best measures of quality, aside from the skill which must be employed in the manufacture of steel, is that represented by the actual extra costs that really result in improved quality. On the other hand, it is also obvious that insistence on a higher degree of quality than is necessary or justified for a given application constitutes an economic waste for someone, and furnishes another example of why the closest cooperation and the highest degree of confidence between the steel-maker and his customer are most desirable from every viewpoint.

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A WIDE range of physical properties can be produced in steel wire by means of chemical composition, heat-treatment, and cold-work. Initial heat-treatment of the rod and heat-treatments in process, such as patenting, are primarily designed to produce in the steel the physical condition best adapted to cold work. It is

true, however, that the selection and control of these heat-treatments influence other special mechanical characteristics in the finished wire, and makes it adaptable to further manufacturing or service operations. Since cold work greatly increases the hardness and tensile strength of steel, it may be considered as a magnifier that will emphasize irregularities in the quality of the steel, as well as faulty practices in heat-treatment and wire-drawing. This influence becomes progressively greater as the carbon increases, and explains why close control in steel quality and wire-mill procedures is so important in the higher grades of wire. Therefore, there exists a joint responsibility between the wire mill and the steel plant in the attainment of the quality required of many special purpose wire-mill products. This calls for all the skill and enterprise each group can contribute and emphasizes the necessity for an open-minded approach to each problem.

✦ ✦ ✦

Steel Wire

RODS may be specified by chemical composition or by grade and quality suitable for a given type of wire.

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THE Technical Committees of the **American Iron and Steel Institute** have prepared steel-products manuals dealing with rods and wire*. These manuals discuss in detail features of grade and quality and contain tables of standard steel compositions designed especially for rod and wire products. All grades of standard steels from low-carbon to high-carbon are covered and the analyses ranges are sufficiently narrow to take care of most of the specific requirements. For the exceptional cases which might not be provided for by a standard composition, there is a special table of standard ranges and narrower ranges that can be used to develop non-standard steels.

✦ ✦ ✦

WIRE rods are a hot-rolled product finished in coils of one continuous length. Wire is produced from rods by cold-drawing, or, in case of flat wire, by cold-rolling.

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THE smallest wire rod produced in commercial quantities is known as a No. 5 rod, which custom has established at a nominal diameter of 7/32 in. The largest wire rod is rolled to a nominal diameter of 47/64 in. Larger sizes are coiled bars and are produced on a type of mill different from the mills designed specifically for the purpose of rolling rods.

✦ ✦ ✦

BEFORE rods can be drawn into wire, the hard hot-mill scale must be removed by acid pickling and a coating must be prepared on the surface of the cleaned steel to serve as a base for lubrication during wire-drawing, and to prevent metal-to-metal contact between the steel and the die. So important are the functions of these several operations that the cleaning house is often referred to as "the heart of the wire mill." Rigid control and extreme care in the cleaning house are fundamental requirements for good wire-mill practice.

✦ ✦ ✦

SINCE the smallest wire rod is 7/32 in. diameter, it is apparent that a large amount of cold work is needed to produce the fine sizes of wire. Steel becomes progressively harder as it is cold-drawn and a point is finally reached where further drafting will permanently injure it. Therefore, annealing or some other type of heat-treatment must be introduced in the wire mill processing to restore the capacity of the steel for further cold work. These conditioning heat-treatments consist of simple annealing for low-carbon steels, and either patenting or spheroidizing for high-carbon steels.

✦ ✦ ✦

THE temper or hardness of the finished wire is controlled by the number of heat-treatments during the process and by the point at which the last heat-treatment is introduced in relation to the finished size. The wide diversity in physical qualities that can be produced in wire depends very largely upon the skill used in the selection and also in the control of these preparatory and intermediate "process" heat-treatments.

✦ ✦ ✦

IT is indeed remarkable that in low-carbon steel wire we may produce material ranging in tensile strength from less than 50,000 to over 100,000 lbs. per sq. in. and in any number of intermediate strengths, by the simple expedient of properly located annealings. Generally, rods of soft steel require no preparatory heat-treatment before drafting is begun. Therefore, except for very special cases, heat-treatment of the lower-carbon grades is confined to process-annealing for relief of cold-work hardness or for control of the final hardness of the wire.

✦ ✦ ✦

"BRIGHT wire" is hard dry-drawn wire made according to normal wire-drawing procedure, without any intermediate heat-treatment designed to alter the properties imparted by normal cold work.

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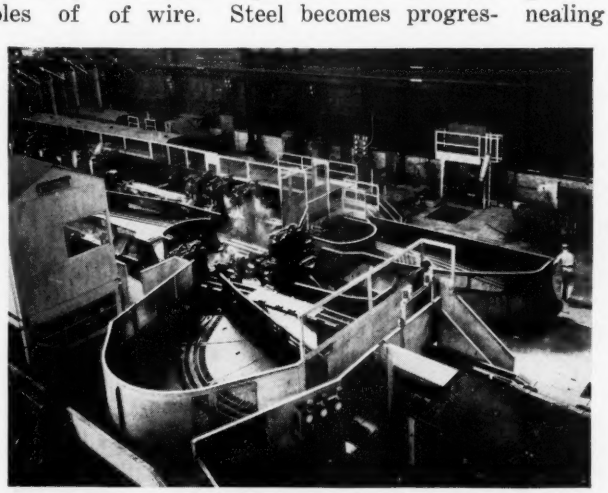
"PROCESSED wire" is a dry-drawn wire, in which an intermediate annealing is employed for the specific purpose of modifying the hardness



A rod-mill in which rods are rolled before being drawn into wire for various purposes.

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*See American Iron and Steel Institute Steel Products Manual — Section 15 and Section 16.

of the finished wire. This annealing may take place at a diameter very near the finished size in order to produce the maximum softness with a drawn finish, or at a somewhat larger size, if harder product is required in a given type of steel.

✦ ✦ ✦

OBVIOUSLY, after each heat-treatment, whether for the relief of hardness to restore capacity for cold work, or for the control of final hardness at finish, the product must again go through the cleaning house for cleaning and coating.

✦ ✦ ✦

WHEN fully-softened wire is desired, it is annealed at the finished size. The kinds of wire annealed at the finished size and the methods of annealing are as follows:*

(a) Pot-Annealed Wire or Black-Annealed Wire is produced by heating the coils or wire in pot furnaces, followed by slow cooling.

(b) Lead- or Strand-Annealed Wire is produced by passing wire in single strands through a bath of molten lead, or through open-fired furnaces, followed by air-cooling. This product is not as soft as pot-annealed wire and is used for special-quality bale ties, or bands, and for other articles requiring greater strength or stiffness than that possessed by pot-annealed wire.

(c) Bright-Annealed Wire is produced by heating coppered or liquor-finished wire in sealed pots under a controlled atmosphere to prevent or minimize oxidation.

(d) Lime-Bright Annealed Wire is produced by heating bright dry-drawn wire in sealed pots under controlled atmosphere to prevent or minimize oxidation.

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***See American Iron and Steel Institute Steel Products Manual, Section 16.**

IN low-carbon steel that has been moderately cold-worked and annealed within certain temperature ranges, a condition is sometimes encountered in which the wire, although soft, exhibits a very brittle character, caused by what is known as germinative grain-growth. This condition can be controlled by increasing the cold-reduction before annealing or by annealing at a temperature above the critical-temperature range of the steel. A moderate increase in the carbon content and also the addition of the deoxidizers aluminum and silicon tend to inhibit this type of grain growth. It is suggested that other phenomena, such as galvanizing-embrittlement and age-hardening, associated with slight degrees of cold work, might be related to the causes which result in germinative grain-growth. It is recognized, however, that the temperature of galvanizing is not high enough to actually cause observed grain-growth. The curves shown in Figure 1 illustrate the effect of cold-working and annealing temperature on germinative grain-size in annealed low-carbon rimmed steel, and in annealed steel somewhat higher in carbon and killed with the silicon and aluminum. The effect of higher carbon and the use of deoxidizers is quite noticeable.*

✦ ✦ ✦

AS applied to wire-mill products, **normalizing** is a heat-treatment to make the medium high-carbon steel wires more adaptable to cold-heading. Wire drawn from rods which have been given a high temperature annealing is called normalized wire. The temperature usually employed is above the critical temperature range and the cooling is retarded. The structure produced is coarse pearlite. Applied to wiremill practice, the term normalizing has a different meaning than when used in the ordinary sense in connection with other steel products. ✦ ✦ ✦

IN the manufacture of high-carbon wire, the rods and the wire in process are given preparatory heat-treatments for the purpose of producing a steel structure that will stand the severe cold work which might otherwise permanently injure the steel. The high-carbon rods may be either patented or spheroidized.

***Curves from the thesis by Theodore B. Winkler, submitted in partial fulfillment of the requirement for the Degree of Bachelor of Science in Metallurgy, Pennsylvania State College, 1939.**

EFFECT OF COLD WORK AND ANNEALING TEMPERATURE ON GERMINATIVE GRAIN GROWTH

STEEL	TYPE	C	Mn	Si	MfQ-E GRAIN SIZE
A	RIMMED	.06	.30	.01	1-4
B	KILLED	.16	.48	.11	6-8

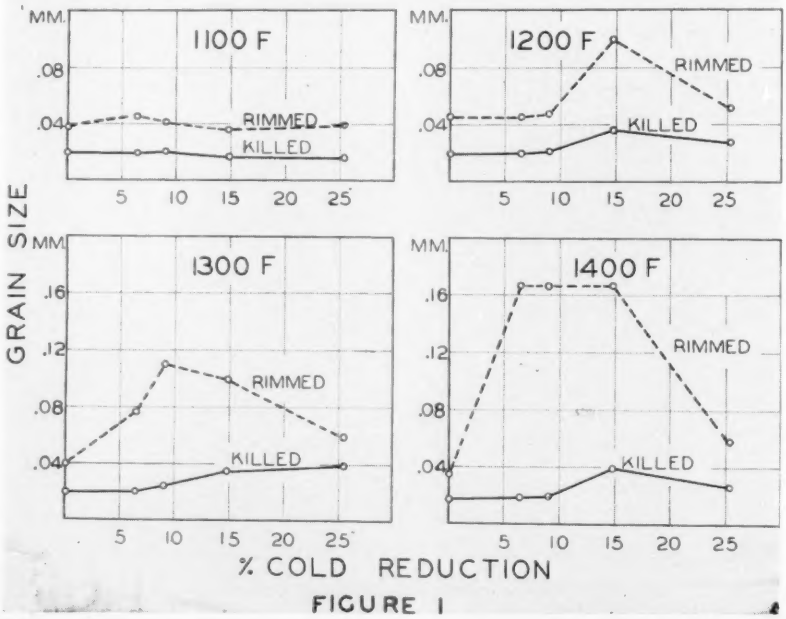

FIGURE 1

Here again, the choice of these two heat-treatments and the details of procedure, as well as the selection of the processing points during drawing, will depend upon the kind of finished product required.

✦ ✦ ✦

PATENTING is an individual strand heat-treatment in which the steel is heated to above its critical-temperature range, and cooled below that range in air, in molten lead, or in a molten salt. The purpose of patenting is to prepare high-carbon steel to withstand the subsequent severe cold-drawing operation. The microstructure produced is of a sorbitic-pearlite type.

✦ ✦ ✦

SPHEROIDIZING is accomplished by giving coils of rods or wire a prolonged heating in pot furnaces at a temperature within or slightly below the critical temperature range of the steel, and cooling at a very slow rate in the furnace. The microstructure produced is divorced pearlitic and consists of globular carbide in a matrix of ferrite. By this type of heat-treatment, high-carbon steels are made almost as soft as low-carbon steels.

✦ ✦ ✦

THE heat-treatment cycle for spheroidizing is, of necessity, longer than the cycle for simple annealing or normalizing. In all of these heat-treatment procedures there is an element of risk in surface decarburization which calls for special precautions and special equipment. This matter of decarburization might be of serious consequence, and obviously presents a problem in long-cycle annealing processes. In springs, for example, excessive decarburization may result in short service life.

✦ ✦ ✦

IN the United States we have an annual capacity of more than four million tons of wire and wire products. The industry is extremely diverse, supplying wire for purposes ranging from pins and nails to wire for the great cables suspending the Golden Gate Bridge and from the softest low-carbon steel weaving wire to the fine, high-quality wire of over 300,000 lbs. per sq. in. tensile strength for aircraft cords, and the high-strength wire for the spring components of the machine guns and rifles used by our armed forces.

✦ ✦ ✦

IN the trade it is conventional to classify wire-mill products into two broad divisions, namely, **"Merchant Wire and Merchant Wire Products"**, and **"Manufacturers' Wire"**.*

✦ ✦ ✦

MORE than half of the nation's wire-mill capacity is devoted to the more-popularly-known **Merchant Wire Products,** which include such commodities as wire nails and staples; barb wire; twisted fence stays; woven-wire fence; ornamental lawn fence and single-loop bale ties. The wire size is always designed in accordance with the steel-wire gauge table.

✦ ✦ ✦

THESE **Merchant Wire Products** have come to be looked upon as common products and few people realize the background of enterprise and skill that made it possible to produce them in such quantities, of such excellence, and at such a low cost. But the fact that modern mass-production methods have phenomenally reduced the cost of these products does not mean that they can be made from steel of indifferent or poor quality.

✦ ✦ ✦

AS its name implies, **"Manufacturers' Wire"** comprises the various grades and qualities of wire used in the manufacture of a wide variety of manufactured products. Each grade or quality is made from steel selected for the purpose and by wire-mill procedure designed to provide the individual characteristics required in the wire. The wire size is designated either by gauge number or by decimals of an inch, depending upon the needs or the custom of the industry for which the wire is prepared.

✦ ✦ ✦

FOR convenience in describing the various grades and qualities, the **American Iron and Steel Institute** committee has divided **Manufacturers' Wire** into four classes as follows:*

1. **Low-Carbon Steel Wires, with carbon contents up to and including those indicated by Standard-Steel number C 1012 (0.10 to 0.15 carbon) in open-hearth steel and B 1011 (0.13 maximum carbon) in Bessemer.**
2. **Medium Low-Carbon Steel Wires, with carbon contents as indicated by Standard-Steels C 1013 (0.11 to 0.16 carbon) to C 1027 (0.24 to 0.30 carbon) inclusive.**
3. **Medium High-Carbon Steel Wires, with carbon contents as indicated by Standard-Steels C 1027 (0.24 to 0.30 carbon) to C 1041 (0.36 to 0.44 carbon) inclusive.**
4. **Special-Purpose Wires, including both high-carbon and low-carbon steels.**

*See American Iron and Steel Institute Steel Products Manual, Section 16.

✦ ✦ ✦

WIRE for **Merchant Wire Products** and also the predominant tonnage of **Manufacturers' Wire** is dry-drawn. In preparing rods and wire for dry-drawing, they are generally cleaned in a dilute solution of sulphuric acid and given a base coating of lime or sull and lime, which is baked on the surface of the rods. The rods thus coated are drawn through a mixture of powdered soap and lime (in the case of high-carbon steel), or a mixture of grease and lime (in the case of low-carbon steel) placed in the die-box in front of the die.

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SOME classes of fine wire, and, when special finishes are desired, some types of coarse wire, are wet-drawn. Frequently, however, the rods are broken down to an intermediate size by dry-drawing and the product finished by wet-drawing. For wet-drawing, the material is usually cleaned in cold hydrochloric-acid solution, washed and then immersed in a solution of metallic salts which provides a base coating of copper or tin, or a combination of copper and tin, depending upon the finish desired. If the solution contains no tin, copper-ed-wire finish is obtained, and if the solution contains both copper and tin, either brass-liquor finish or white-liquor finish is obtained, depending upon the proportion of tin. After being coated, the wire is drawn wet either through a liquid lubricating solution or from a tub in which it is immersed in a liquid lubricant. In this country wet-drawing is confined to a relatively small tonnage of special steel wires.

✦ ✦ ✦

BY utilizing the many combinations of heat-treatments and drafting, and the different clean-

ing-house practices, a long list of finishes and physical characteristics can be produced in the four general classes of **Manufacturers' Wire** outlined above.

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WITH the development and the growth in the number of specialized wire items which modern machine development has stimulated, the demands have continuously increased for higher quality and greater precision in performance of **Manufacturers' Wires.** This has challenged the skill of the wire industry, and has emphasized the need for close control of heat-treating processes and every other detail in wire-mill procedure. Closer attention is given to refinements in cleaning-house practice, in the choice of dies and their maintenance, in speeds and reduction used in drawing, in lubricants and coatings, and even in the control of temperatures developed during drawing.

✦ ✦ ✦

IT is not generally realized how much of the burden of these advancements and improvements has fallen upon the rod. Frequently the demands for surface perfection and uniformity in composition have taxed the facilities and the abilities of the steel plants. This is true not only of the special-purpose wires, but of the more familiar types of **Manufacturers' Wire** such as cold-heading wire, from the soft steel for common bolts and screws to the higher-carbon and alloy stock for heat-treated heavy-duty parts.

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WIRES for cold-heading and similar operations are important items in the first three classifications named under **"Manufacturers' Wire".** Cold-heading methods and cold-headed or cold-forged products have developed rapidly in recent years. At one time soft wire only was used in cold-heading operations. Higher-strength bolts and screws were either hot-headed or machined from bar stock. Now wire drawn from steel high enough in carbon to produce heat-treated bolts and screws is cold-headed without hesitation.

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FOR severe upsetting or cold-forging, and particularly in the

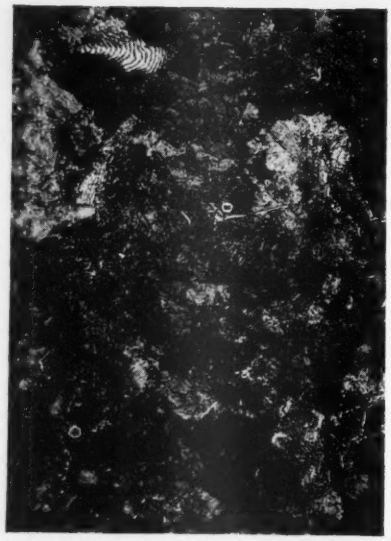

Fig. 2. Air Patented 0.75% Carbon Steel. Magnification: 500 Diameters.

✦ ✦

case of the harder grades of steel, the wire should be ordered in either normalized cold-heading quality or spheroidized cold-heading quality, depending upon the grade of steel or the severity of the cold work. Generally, when steel much over 0.25 per cent carbon is used for cold-upsetting or cold-forging, the stock should be normalized or spheroidized. When the severity of the cold-forming exceeds the capacity of a cold-drawn structure, it may become necessary to use wire which has been spheroidized as a final operation after cold-drawing, especially if the carbon is high.

✦ ✦ ✦

UNTIL recent years, lubrication and coating problems in dry-drawing wire were related chiefly to the operation of the wire-mill itself. With the introduction of the extrusion-heading processes, however, it became necessary to develop a coating finish which not only provided for successful wire drawing, but which would also serve as an adequate lubricant in the later severe extruding operation. This has involved special cleaning-house practice and other special wire-mill practices. Moreover, the use of higher-carbon steels in these products has made it necessary to introduce refinements in steel-making practices designed to assure internal soundness, uniformity in composition, freedom from injurious surface imperfections, as well as satisfactory cold-forging properties and proper response to final heat-treatment under standard manufacturing conditions.

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THE manufacture of wire for coated welding electrodes furnishes another example of specialized steel-making and special wire finish. The requirements involve extra precautions in the manufacture and selection of steel and in the preparation of billets and rods. The chemical composition must be closely controlled within restricted limits, the steel must be tested for welding quality, and the surface of the wire must be exceptionally clean to assure proper bonding of the flux coating applied by the electrode manufacturer. For grades up to 0.35 per cent carbon as the maximum of a specified range, rimmed steel is generally supplied. For grades over 0.35 per cent carbon as the maximum of the range, killed steel is used.

✦ ✦ ✦

BECAUSE of the great variety of uses and the individual qualities required of the many wire items classified as **"Special Purpose Wire",** it is not possible to define many of them by standard grades or qualities. It is, therefore, frequently impossible to set up exact specifications for some of these products because at times it may be necessary to vary slightly the hardness or stiffness of wire for different manufacturers making the same finished product, on account of slight variables in the procedures followed by those different manufacturers. Therefore, except in relatively few cases, the purchaser's individual requirements are studied and the interpretation by the wire manufacturer becomes the controlling factor in the selection of the type of steel and in establishing the wire-mill practice.

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THE properties which make a given **"Special-Purpose Wire"** suitable for a given use are a composite of its chemical composition and the technique employed in its manufacture. Because of this, chemical analysis alone cannot adequately define special purpose wire: physical characteristics are more nearly descriptive, but there

are many cases where even those physical characteristics cannot be satisfactorily or precisely defined. This is one of the reasons why there are so many specialties produced by the large group of specialty wire mills. The satisfactory performance of these special commodities is so largely depending upon definitely devised and closely-controlled processing developed by the wire manufacturer for the service the product must perform, that frequently a given kind of special-purpose wire can be described by commodity name only.

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IN the case of the very high-carbon products such as needle wire, or where the purpose may be to confer a better degree of machining quality in moderately high-carbon and alloy-steel wires, the preparatory and process heat-treatment is spheroidizing. The manufactured products from this class of wires are generally hardened and tempered in the finished form, or just prior to finish-grinding or polishing.

✦ ✦ ✦

ROPE wire, spring wire and many other special-purpose wires are drawn from patented stock. Many of these are used in their final hard-drawn condition. Oil-tempered wire, and similar products requiring a physical condition differing from that resulting from cold work and process heat-treatment, are given tempering or annealing treatments at the finished size.

✦ ✦ ✦

THE kind of patenting (air-patenting or lead-patenting) and the temperatures employed will depend upon the particular wire commodity produced and the special physical properties required for each use. The amount of reduction per draft and especially the total reduction after the last patenting

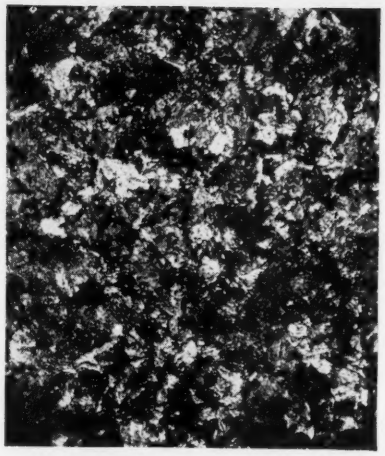

Fig. 3. Lead Patented 0.75% Carbon Steel. Magnification: 500 Diameters. ✦ ✦

will depend upon the size of the finished wire and its kind. For example, in rope wire of a given size, the reduction per draft and total reductions might be set up as 20 per cent and 75 per cent, respectively, while for music spring wire the reduction per draft should be much less, and the total reduction is frequently in the neighborhood of 90 per cent; the patenting procedures for these two examples would also differ.

✦ ✦ ✦

THE reason for this is more apparent when we consider the difference in fundamental physical characteristics. In the case of the high-strength spring wire, the maximum of resilience or hardness is required. For this kind of wire a higher-carbon steel, a somewhat harder final patented structure, and more cold-work hardness are needed. Except in very special cases, the carbon content of steel for rope wire, even for the high-strength grades, is lower, and a milder patented structure and less cold work is employed in order to provide that combination of strength and tough ness better adapted to survive the service distortions incident to wire-rope service.

✦ ✦ ✦

IT is conceivable that after the first draft, steel is in a state that might be described as a condition of plastic flow. This hypothesis may explain the ease with which steel will take repeated drafting until the area has been reduced to a fraction of its original size before its softness has to be restored by annealing to permit further cold-working. At any rate, if steel in this moderately cold-worked condition more closely approached what we might term truly elastic properties, it is questionable that it could be cold-drawn as far as in conventional practice.

✦ ✦ ✦

STEEL drawn to the degree customary in current rope-wire practice, does not possess the truly elastic properties characteristic of hardened and tempered steel. It does not appear to have nearly so high a proportional limit in comparison to the tensile strength. "Tempering" cold-drawn high-carbon wire, by heating to about 550°F., and air-cooling, materially increases its resilience and raises its elastic properties, but also, to a degree, decreases its capacity for further cold work.

✦ ✦ ✦

IN rope wire it appears desirable to so regulate patenting and drawing practice that a certain degree of cold-flowing capacity remains in the finished wire. This capacity for

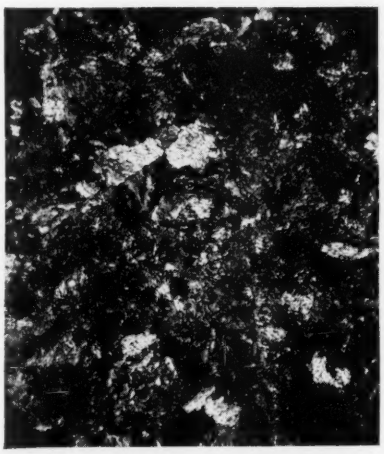

Fig. 4. Lead Patented 0.85% Carbon Steel Cold lead temperature 1100°F. Patented Stock 167,000 lbs./sq. in. Tensile Strength. Magnification: 500 Diameters. ✦ ✦ ✦

Fig. 5. Lead Patented 0.85% Carbon Steel. Cold lead temperature 1025°F. Patented Stock 174,000 lbs./sq. in. Tensile Strength. Magnification: 500 Diameters. ✦ ✦ ✦

cold flow is, of course, not required for further cold-drafting, but it is of great value in enabling the wire to easily adjust itself to the deformations imposed by wire-rope service.

✦ ✦ ✦

ON the other hand, in material as hard-drawn as music spring wire, this tendency to adjust itself to loading by cold flow is not desirable. Consequently, harder steels are used, a different patenting procedure is employed, and the wire is drawn harder. Of course this practice severely taxes the capacity of the steel and accounts for the fact that steel for music spring wire must be of the highest quality, because, regardless of the fact that such comparatively drastic wire-mill practice is needed and employed, the finished wire must be able to perform satisfactorily under severe and repeated service stresses.

✦ ✦ ✦

PHYSICAL metallurgy has been of great help to us in evaluating and visualizing the structural changes in steel resulting from the several heat-treatments and their variations that are employed in processing wire. However, the men skilled in wire-drawing had definite conceptions of the value of the various heat-treatments, and knew from practical experience how to apply them for each individual commodity before our metallographic knowledge reached a point where it was of much assistance. The development of patenting practice is an outstanding example of this. It was known that by using lead furnaces and varying the temperatures, particularly that of the "cold" lead bath, the range of physical properties shown by cold-drawn air-patented stock could be definitely extended, and they were aware of the fact that this was due to the differences in physical properties of the patented stock. The influence of varying drafting practices, and the fact that steel that had received a definite amount of cold work responded more actively to subsequent patenting treatments were also understood. The improvement in quality of the final product as shown by the smaller

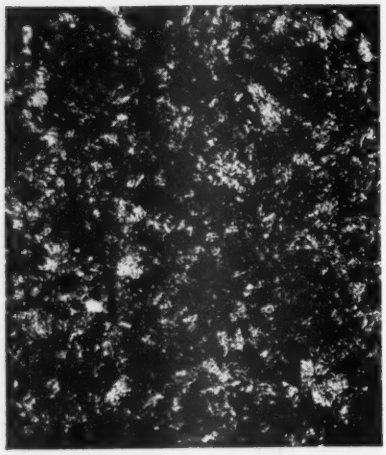

Fig. 6. Lead Patented 0.85% Carbon Steel. Cold lead temperature 950°F. Patented Stock 184,000 lbs./sq. in. Tensile Strength. Magnification: 500 Diameters.

✦ ✦ ✦

sizes of wire resulting from repeated cold-drawing and repatenting was known and understood. As now, the best material was produced by men who were most skillful in the control of these operations and who insisted on painstaking attention to every detail.

✦ ✦ ✦

PHYSICAL metallurgy has given us a better appreciation of the fundamental principles involved in making the various types of high-carbon wires. Better furnace equipment, and means for closer temperature control have aided materially in the improvement of quality and in the development of more highly specialized products. The microscope has helped us to visualize better the structural difference between air-patented stock and lead-patented stock and the effect of various "cold" lead temperatures in lead patenting. Strictly speaking, we have not developed anything that is fundamentally new, but improvements in equipment enable us to more closely control the particular procedure best suited to the problem in hand.

✦ ✦ ✦

WHEN a rod is air-patented, it is heated to a temperature substantially above the critical temperature range of the steel, and cooled in air. In this operation the rod loses temperature relatively rapidly until the steel passes through the recalescence point where heat is generated, resulting in a slight rise in temperature. This phenomenon is easily seen and recognized. The heat generated accompanies the transition of the structure toward a more definite pearlitic type, especially in larger sizes which cool more slowly. Recalescence is suppressed to a greater degree in lead-patenting than in air-patenting. As a consequence, lead-patented stock is harder than air-patented stock, the difference depending principally upon the temperature of the "cold" lead. This difference manifests itself in the respective microstructures of the steel and in the physical properties of the patented stock. Figures 2 and 3 illustrate microstructures obtained in air-patented and in lead-patented 0.75 per cent carbon rope-wire steel, and Figures 4, 5 and 6 illustrate the influence of various "cold"-lead temperatures on structure and tensile strength in lead-patented 0.85 per cent carbon steel.

✦ ✦ ✦

IT is clearly impossible in this review to discuss all of the specialty wire-mill products which have been developed to meet the constantly-increasing needs of the manufacturers and the engineers who use wire in producing the equipment and appliances required by modern life. But it is not difficult to realize that the extensiveness of the field has been made possible by the great diversity in properties brought into being in steel by alloying iron with only relatively small amounts of carbon and other elements. This diversification is not approached by any other material. No less remarkable is the further enhancement and extension in the range of these physical properties resulting from a combination of cold work and heat-treatment applied to these various types, grades and qualities of steel.

✦ ✦ ✦

EVEN though we recognize the progress already accomplished through scientific development and skill, we can confidently look forward to further impressive accomplishments in the future, as our fundamental knowledge of steel-making and its cold-working is extended and our facilities and methods are still further improved.

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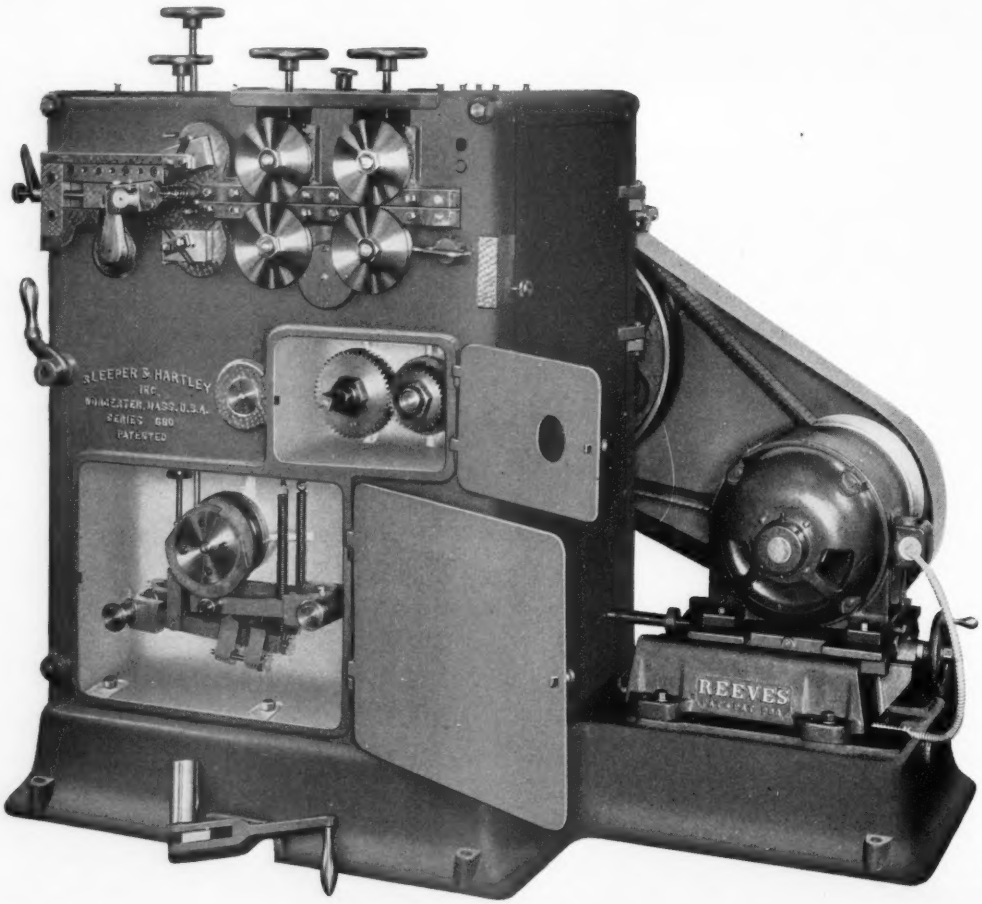

PATENT No. 2,175,426

SLEEPER & HARTLEY, Incorporated
Worcester, Massachusetts, U. S. A.

Whoosis for President

By Kenneth B. Lewis,

Consulting Wire Mill Engineer,
Worcester, Mass.

An interview with the well known industrialist on topics of the day. A previous interview was published in "Wire & Wire Products" under the title of "United We Stand—Or Do We?" ✦ ✦ ✦

I FOUND Mr. Whoosis in his library clad in a sweat shirt and bathrobe, seated close to a fire of briquettes in a cast iron grate basket. "Glad to see you, my boy," he said. "pull up to the fire. The Federals have got to me at last. I have to carry my thermostat at 55°, but my bootlegger got me a few of these rabbit buns and I'll pull through. What can I do for you?"

✦ ✦ ✦

"MR. WHOOSIS," I replied, "my editor wants me to get your comments on the rumor that there is a movement on foot to nominate you for the presidency of the United States. Do you consent to be interviewed?" "Yes."

✦ ✦ ✦

Q. What is your comment then, Mr. Whoosis?

✦ ✦ ✦

A. Don't be silly, sonny. Why should I want to be president? I don't like to be photographed. Mrs. Whoosis doesn't like to travel, and our sons want neither commissions, nor divorces. What have we to gain?

✦ ✦ ✦

Q. Please be serious Mr. Whoosis. Do you think it's quite fair to criticize the president and his family for personal traits?

✦ ✦ ✦

A. I remember that in my youth presidents had official lives and private lives, and their privacy was respected. Times have changed. Mrs. Roosevelt for example, was never elected to anything, nor has her appointment to any post ever come before the Senate for confirmation. Every business enterprise with which she was ever associated has gone into bankruptcy. When she, personally and openly, and in defiance of the clearly expressed will of the congress, bootlegs into the body of the law an economic absurdity like the salary limitation, it's a fine state of affairs if she can't be criticized.

✦ ✦ ✦

Q. But getting back to these rumors, Mr. Whoosis, please be serious. My editor expects me to get him a statement.

✦ ✦ ✦

A. Rumor or no rumor, the thing is too silly to notice.

KENNETH B. LEWIS
Consulting Wire Mill Engineer, Worcester, Mass. The Wire Association Mordica Memorial Lecturer for 1941. A member of The Wire Association. Born Bridgewater, Mass., and educated public schools, Quincy, Mass. A.B. Harvard University. From 1904 to 1907 with Bethlehem Steel Company, becoming Asst. Supt. of open-hearth furnace. From 1907-1909 with the American Steel & Wire Company, Worcester, experimental work on wire. From 1909-1932, Morgan Construction Company, building wire mill equipment. In 1932 established own practice as Consulting Engineer in which occupation he is now engaged. Prior to the reported interview with "Mr. Whoosis", Kenneth B. Lewis, presented through the columns of WIRE & WIRE PRODUCTS two political analytical articles one in August, 1941, under the title "Rats in the Corn Crib" and one in June, 1942, entitled "Labor Relations". The first interview with 'Mr. Whoosis" was published in February, 1942, under the title "United We Stand—Or Do We?"

Q. Why so? Can't any American aspire to the highest office in the land?

✦ ✦ ✦

A. Any American except J. J. Whoosis—he's disqualified on too many counts.

✦ ✦ ✦

Q. For instance?

✦ ✦ ✦

A. Well, take the matter of the fire-side chat, which has now taken its place among our traditions. I'm not sure there isn't a "directive" on the subject. I couldn't make a fire-side chat in the orthodox form.

✦ ✦ ✦

Q. Why not? You're a good speaker.

✦ ✦ ✦

A. Thank you, my boy, thank you. But I couldn't seclude myself for five or six days beforehand and pass out word that I was at work on my speech, and then deliver a half-hour of sonorous platitudes, that mean nothing; or worse, that mean seven different things to seven different pressure groups. I should probably take half an hour for preparation and ten minutes for the chat, hardly worthwhile lighting the fire, and when I got through they'd know they had been told something, and they'd remember what it was.

✦ ✦ ✦

LISTEN, boy, if I had a boss, which God forbid, and if he asked me how things were going, I'd sit right down and tell him cold turkey. If I had a cashier, or a head-bookkeeper, and asked him. "Henry, how do we stand?" I'd expect him to sit down and tell me. If he excused himself and spent five days in his private office with his lawyers around him I'd suspect he was cooking up a second set of books, and I'd fire him.

✦ ✦ ✦

NOW see what I've done? I've alienated the votes of all our

people who want a president to croon to them. That's quite a block of votes.

✦ ✦ ✦

Q. Are you referring to the president's broadcasts on Pearl Harbor? I should think you would realize, Mr. Whoosis, that sound military reasons existed that forbade a full report on that disaster until it had been repaired.

✦ ✦ ✦

A. I wasn't thinking about that especially, but as you bring it up, I'll speak my mind. If the president had said frankly that the Japanese had beat the bejasus out of us, and that he would not report in detail for military reasons, I should have respected him. But why must he give us a phony report and swear that it was correct? The Japs knew more than we did. Imagine the solemn farce of sending Justice Roberts to Pearl Harbor to make a "complete report." I can picture him getting back to Washington and having his report handed to him to sign! Even now what do we get? So many battleships "repaired or to be repaired." It smells to me like the early White House reports on preparedness, so many thousands of units "built or building," so many planes "ready or on order."

✦ ✦ ✦

Q. Mr. Whoosis, are you dissatisfied with our progress in the war?

✦ ✦ ✦

A. Absolutely not, sonny. Our armed forces are superb, and I think their leadership is competent, if it is not shackled. I assume, and fervently hope I am right, that the awful fiasco of Pearl Harbor taught certain Meddlesome Matties to keep their civilian fingers out of Navy discipline. I wouldn't criticize military affairs anyway. When I stick my neck out, it will be over things I know about, and, strange as it may seem, I do not, like other civilians, fancy myself a strategist.

✦ ✦ ✦

Q. Incidentally, Mr. Whoosis, and while I think of it, how do you interpret the recent election returns? What do they mean to you?

✦ ✦ ✦

A. Well, chiefly that the rats who deserted the sinking ship are creeping back. The ship they transferred to is either sinking, or stinking, I don't know which way they figure it. Personally, I'd like to drive them out again. They are no asset to any party.

✦ ✦ ✦

Q. But, Mr. Whoosis, don't you realize that among these so-called rats who flocked to Mr. Roosevelt, there were a number of business men and manufacturers, whose traditional home is in your party?

✦ ✦ ✦

A. Did I say rats? Rabbits is the term for them. You must realize that in the lush days of the late 1920's, a lot of shoe-string peddlers attained the brevet rank of "business man." They thought they could swim like trout but they were actually floating with the tide. When the pinch came they ran shrieking to mamma. Damn them all; they are beneath contempt. They elected Roosevelt. Now they're in the money again, and they're getting cocky. The band wagon is going in the other direction, and they're climbing aboard. I'd like to kick them off. They haven't got the kind of guts that built America. They are unfit to perform the duties of a citizen in a republic. They function best under a paternal government. By the way, there goes the Independent Vote. Do you begin to see why I couldn't be elected President?

✦ ✦ ✦

Q. I see that you hold strong views, Mr. Whoosis, but aren't you a little rough on the independent voter?

✦ ✦ ✦

A. Who is the independent voter? A man without a party, and hence a man without political principles. A man who regards personalities rather than principles. To hell with such citizens—they are a drag on our political system. I know them. Confidentially, I ran off the rails myself in my youth. Whisper it not in Gath, tell it not in the streets of Ascalon, but I fell for T. R. and went off with the Bull Moose. I can excuse young men for such follies; a young fool is bearable, but deliver me from an old fool.

Q. Speaking of personalities, Mr. Whoosis, what outstanding personalities in the Republican ranks do you see as presidential timber?

✦ ✦ ✦

A. I don't want my party to nominate a personality. I am sick to death of glamor boys. I should like to live out the rest of my life under quiet inconspicuous presidents. I am content to go to the theatre when I want to see prancing and posing, and to hear oratory and wise-cracks and crooning. I don't want my president to be actually dumb, but if he knew himself to be a poor speaker, and avoided the rostrum as much as possible, how happy I would be!

✦ ✦ ✦

Q. You sound as though you were yearning for another do-nothing president like Coolidge.

✦ ✦ ✦

A. Precisely, buddy; I'm glad I have made myself clear. Coolidge just sat and watched the country run. Maybe that's why it ran so smoothly. Have you noticed that down through the years our periods of quiet prosperity have come in the terms of do-nothing presidents? Could that be cause and effect? Actually there is very little useful help that a president can safely offer. Mr. Hoover is a man for whom I have great respect, but we would have passed through the great panic a whole lot easier if he had not felt impelled to use the power of his office to impede the natural forces of recovery. Of course he thought, as did most people, that when he called the employers together and got their pledge not to reduce wages, he was doing something of a humanitarian nature. Actually he was suppressing symptoms and driving the fever in.

✦ ✦ ✦

Q. What would you have had him do, Mr. Whoosis, stand back and let the fever rage?

✦ ✦ ✦

A. Certainly. It's the hardest thing in the world to do, to stand and do nothing, but how many times is it the right thing! A fever is not a disease, it's merely the outward evidence that disease is present, and that the curative agencies have started fighting

it. In the business world, deflation is the fever that cures economic indigestion. It is a natural process, and if it is violently interrupted the malady goes in deep and lingers long.

✦ ✦ ✦

Q. How do you think Willkie shapes up as a candidate?

✦ ✦ ✦

A. Confidentially, he's a little too much of a personality. He's inclined to be a prancer. I don't like to say too much, for I may be wearing his button again, but he started out in life a Democrat, and I think he's still a Democrat, though anti New Deal. Too much the humanitarian. I notice that he shares the president's notion that after this war we must make ourselves responsible for the welfare of the whole world; you know the stuff, a quart of milk for every child, a car in every garage. The United States is to arrange purchasing power for the backward and devastated regions.

✦ ✦ ✦

PURCHASING power; where have I heard that phrase before? It's an eight dollar word for a hand-out. We establish their credit here, and take their bonds. We even print the bonds for them. We ship goods against the credits; then they have the goods and we have the bonds. By the way, remind me to give you an armful of bonds when you leave; there are some nice engravings on them that the kids can cut out for paper dolls. Do you remember how F. D. R. crucified the Republicans for going through that routine after the other war? No? That man is a marvel; he can reverse himself so many times he just looks like a blur, and nobody but me ever notices it!

✦ ✦ ✦

Q. You don't think much of the State Department's plans for postwar trade, Mr. Whoosis?

✦ ✦ ✦

A. I don't believe in any sort of trade that a government agency has to nurse. What in hell has the government to do with trade? Anything that our people need from a foreign country our merchants will go and get, and anything of ours that they want we'll deliver. To hell with credits. Since time began, merchants have known how to make deals, and no tit-willie from Washington can teach them anything.

✦ ✦ ✦

MOST of this export and import fuss revolves around the South American countries. Mr. Hull and his associates think we should trade with them for sentimental and political reasons. That sort of trade has to be nursed, and forced, and jacked up with folding money, and it'll bleed us to death. Those folks have stuff we need; we'll get it, if Hull will keep his shirt on. We have stuff they want, and they'll get it without any rannigazoo from Washington. But they raise cattle and grain, and we raise cattle and grain, and why we must swap it back and forth at a loss is beyond my comprehension. Europe needs their cattle and grain, and Europe should have the privilege of paying for it in manufactured gimcracks. That trade is established.

✦ ✦ ✦

THE South Americans are of recent European origin, they speak European languages, they copy European architecture, read European literature, and take their vacations in Europe. European traders go there and settle, marry their girls, talk their language, take their citizenship, mix in their politics. I think it's just plain silly for us to try to break up that cycle, sell to them at a loss, take their beef, which we don't want, and go around grinning and flattering them just to please Mr. Hull. Leave it to the merchants and I'll guarantee the trade will be profitable to them and no expense to the taxpayer.

✦ ✦ ✦

Q. You feel, Mr. Whoosis, that we need less Government in business?

✦ ✦ ✦

A. Listen, brother. The keenest brains in this country are in business, and most of the crackpots are in government. Draw your own conclusions. If you have any doubts, come over some week end and we'll look through my collection of goofy questionnaires. I won't say a word, I'll rest my case on the questionnaires, you to be the judge. **Thomas Jefferson,** a sort of patron saint of the Democrats when they happen to be going his way, said "If we depended on Government to tell us when to plant and when to reap, we should soon want bread." Everything the Government touches withers. Except of course the public debt.

✦ ✦ ✦

Q. That brings up another question, Mr. Whoosis. What do you think of Mr. Morgenthau and our finances in general, and of the danger of inflation?

✦ ✦ ✦

A. Henry Morgenthau is a nice fellow, but awful dumb. That's a verbatim quotation from one of his college pals, and it is confirmed by one of my relatives. I had a distant cousin who had a permanent post in the treasury. He had to give it up soon after Roosevelt came in; poor fellow, he had an impediment in his speech that made it hard for him to pronounce the word "billion."

✦ ✦ ✦

ANDREW MELLON, the best man this country ever had in the Treasury, a man to whom our finances were mere mental arithmetic, used to pride himself on his small daily balances. Morgenthau speaks boastfully of the enormous sums he keeps tied up. Mellon knew that money in the treasury drew no interest. I'm amazed that Henry, with his background and racial heritage, doesn't get the point. I'll give him what credit is due him, though; he has the right idea about what sort of tax would curb inflation. He's about the only man in Washington who will speak a good word for a sales tax.

✦ ✦ ✦

Q. Why Mr. Whoosis, you shock me! Would you lay such a burden on the poor laboring man?

✦ ✦ ✦

A. Poor, my clavicle! The laboring man is the man whose income has sky-rocketed. Even laying aside that fact, he is the only adequate and logical source of added revenue. Adequate, for the same reason that bay horses eat more than white horses—there are more of them. They are the only class large enough to be

worth considering in a tax program. Logical, because they constitute the very class that is hell-bent on plunging us into inflation. Who is it that plunges about in a rising market trying desperately to get his swollen wages onto his back or into his belly? Isn't it the laboring man? People of means didn't get that way buying in a runaway market. They are the type that buy when goods are cheap, and coast along, economically, when the scramble for a diminishing supply of consumer goods has boosted prices. They are guided through such periods by the same instincts that made them well-to-do. They save their money and invest it in productive enterprise. Roosevelt and his dreamers want to tax this money away from them, and a pitifully small yield it would bring the treasury, but they shrink from interfering with the delirium of the munitions worker. Morgenthau has the right idea, and I'm glad to be able to say a kind word for him.

✦ ✦ ✦

Q. Don't you think, Mr. Whoosis, that anything that cuts so drastically into the purchasing power of the working man is bound to jeopardize our social gains?

✦ ✦ ✦

A. What social gains? I haven't seen any social gains. If you are referring to the recent New Deal measures which pretend to guarantee men richer food, free housing, abundant leisure and entertainment and ample support through strikes and voluntary stoppages, in return for a minimum of languid attendance at their places of employment, I can only remind you that gains of this sort are on a par with the paper profits that banished poverty in 1929. They are a mirage. We won't find it out till we try to cash in. Since 1932 our finances have been juggled so swiftly that no human power can estimate where we stand. We issue bonds secured by bonds, we pay interest on interest by issuing more bonds, we are eating up our substance, sawing off the limb on which we are perched, painting ourselves into a corner of the kitchen floor.

ANDREW H. BROWN, of the celebrated firm of Amos and Andy, decided to go on a budget. He got hold of a budget book, and after looking it all over, decided to adopt the budget calculated on an income of $300 a month, because it allocated such a marvellous amount to vittles. Amos pointed out that Andy didn't have the $300 income, but Andy couldn't see where that made any difference. That's just about where our social gains stand. The New Dealers have picked out a budget for the voters, and are now hopefully waiting for the national income to catch up to it, meanwhile gradually pawning the silver and breaking up the furniture for fuel.

✦ ✦ ✦

"GUNS or butter" is the way the realistic Nazis express it, Roosevelt trys to kid us into the belief we can have both. Nobody has the guts to put over the truth that we have got to cut our standard of living down, down, down, below depression levels, to feed the enormous war machine which our survival requires.

✦ ✦ ✦

IT makes me sick to see millions of dollars frittered away on complicated schemes of rationing. The only simple and effective way to keep men from eating too much, loafing too much, drinking too much, and wasting the national substance, is to see that they have so little money that they have to work every possible minute and cut every possible corner to keep their backs warm and their bellies from growling. And the only way to insure this is either to let them have very little money, or take it away from them as fast as they try to spend it, by some such device as the sales tax. I have no illusions about the human race. Ninety-five percent of them hold the rank of moron only by courtesy. Let them get their hands on folding money and it'll be on their backs or in their bellies before you can say Pearl Harbor.

✦ ✦ ✦

BY the way, buddy, there goes the vote of the laboring classes!

Q. Speaking of laboring classes, Mr. Whoosis, are you still of the opinion that labor is our chief problem in this crisis?

✦ ✦ ✦

A. You know very well what are my views on the labor problem. It is at the root of everything. I hear talk about a shortage of man power. Nuts! What we suffer from now is a failure to get any horse power out of the men we have. The short work week, adopted in hopes of spreading as thinly as possible what was once regarded as a fixed amount of work, now becomes one of our "social gains," and our supergovernment, whose delegates slip in and out of the back door of the White House, won't let it be touched. Listen, boy, here's a good one you may have missed. The Department of Labor has established a commission to investigate the problem of fatigue in laboring men! Imagine those goddam pansies getting fatigued! If there are any symptoms of fatigue they undoubtedly result from excessive pub-crawling and miscellaneous rioting that mark the futile efforts of the brainless to while away the tedious hours between their ridiculous little tours of duty.

✦ ✦ ✦

I DON'T worry too much about inflation, or national bankruptcy, or destruction of our physical assets by enemy action. The survival and the eventual prosperity of a people hinges on its willingness and ability to work long and hard under intelligent supervision. People who have those qualities can't be kept down. The crime for which **Frank Roosevelt** will ultimately be arraigned at the bar of History is the deliberate and thorough debauchery of the working man.

✦ ✦ ✦

STOP—I know what you're going to say. You're going to rant about the marvellous records in production now being hung up by our gallant defense workers (when they are not on strike, or on a slow-down, or a sit-down, or a work holiday, or a pause to adjust a jurisdictional dispute, or an "unauthorized" stoppage, or a

demonstration of sympathy, or any one of those euphemistically described bits of skullduggery that are so named to keep them out of the strike statistics.) I suggest to you that our achievements in production are the result of brains in management, supervision, and planning, and that labor is dragged along, and turns and bobs up just in time to take the bow and accept the Navy E. How do you explain the unchallenged fact that British ship-yards, lacking our marvellous equipment, turn out 50% more shipping per man-hour than ours? Green and Murray keep dodging the question.

✦ ✦ ✦

LABOR is a festering sore on the body of America, and the blame lies with one man, and one man only, the president of the United States. If the G-men want to come and get me for that, here I sit waiting for them. The relief I feel at having got that off my chest transcends any discomfort that may await me in the federal pen. I know it is true, you know it is true, everybody knows it. I've said it. Atlanta, here I come.

(There goes the Union Labor vote).

✦ ✦ ✦

Q. You seem quite pessimistic today, Mr. Whoosis. Don't you think this country has any future?

✦ ✦ ✦

A. I'm just answering the questions, and can I help it if you ask the ones that have sour answers? As for our future, I will say that hope springs eternal in the human breast. I can see that we are just passing through one phase in a long cycle. Have you ever read Oswald Spengler's book on the decline of civilization? I believe it's been translated into English. You ought to look it over. Spengler has traced a long series of civilizations that have arisen and decayed throughout recorded history. They average 1400 years each, and the cycles are almost identical. I'll run through one for you.

✦ ✦ ✦

THE human race manufactures most of its own problems by the simple process of periodically penalizing or destroying those talented members of the race capable of solving them. When nobody has anything and we all live in squalid misery in caves and under fallen trees, fighting with the beasts for our food, there arise certain individuals who have vision, managerial skill, and the capacity to exercise a present self denial in the hope of future gains. Such individuals start a slow and painful sort of rudimentary industry. They encourage men of special skills to devote themselves to apparently non-productive tasks, feeding and clothing them meanwhile out of their own hoarded stores. Little by little they build up self-sustaining communities in which each man plays the role to which he is best suited, some hunting, some fishing, some making weapons, some making household conveniences, all fed, lodged, and protected from predatory tribes by the "capitalist" who heads the outfit.

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IN the course of time some form of money is invented, and the workers secure a measure of independence, live apart, and to some extent plan their lives. Their dependence becomes less patriarchal and absolute.

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OUT of this background grow industrial systems, such as ours. One unvarying phenomenon is that the employed class, relatively secure from marauders, and from the hazards of starvation and freezing, well-fed, warm, and with increasing leisure and no intellectual resources, begins to breed at a rapid rate. Natural forces no longer restrict breeding to those fittest to cope with natural forces. Soon there is an ample supply of citizens with strong backs and weak heads, who in a state of nature would starve in a week, but for whom management and capital feel obliged to find the only sort of employment that they can compass. In this way is the "proletariat" built up.

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IN the early stages of this cycle, those who invent, dream, save, risk, and create industries, reap rich reward, the reward coming in such form that it can be employed almost solely in bodying forth further dreams and visions. These men support not only the herd but a large class of the semi-talented, the minor executives, and the service battalions. The business man becomes the popular hero.

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BUT when a nation has enjoyed several generations of prosperity, individual superority begins to be looked upon with suspicion. The processes look so easy that demagogues arise and cry that special privilege is unfair, that the laboring man creates the values that seem to flow from his labor, that he is being forced to support a horde of parasites, and that he should seize the tools of industry and become his own master. He does so, and after a prolonged debauch on the stored industry of several generations, the bottom of the keg appears, organized society falls apart, 99% of the population dies of malnutrition, and the long cycle starts again.

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NO region, once having passed through this cycle, has mustered energy to repeat. Egypt is sunk, Greece is only a memory, Sumeria is hardly even a memory. The civilization of which we form a part is that of Western Europe, which arose about 1000 to 1200 years ago out of unbelievable squalor, paced by the "renaissance" of Italy which marked the ending of the Dark Ages that followed the extinction of the old Roman Empire. I shall leave you to determine just where we stand in the time cycle at this moment. Maybe the word "demagogue" will give you a clue.

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Q. Mr. Whoosis, stop—you are breaking my heart. Is there no hope for civilization? Are we to go down into another horrible dark age?

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A. I'm not making the predictions, bub, I just supply the data. I will say that, however, ours is the first civilization to arise under the aegis of the Christian religion. It has much to commend it in the way of tolerance and charity. And furthermore,

(*Please turn to Page 86*)

HOLDEN *Announ*

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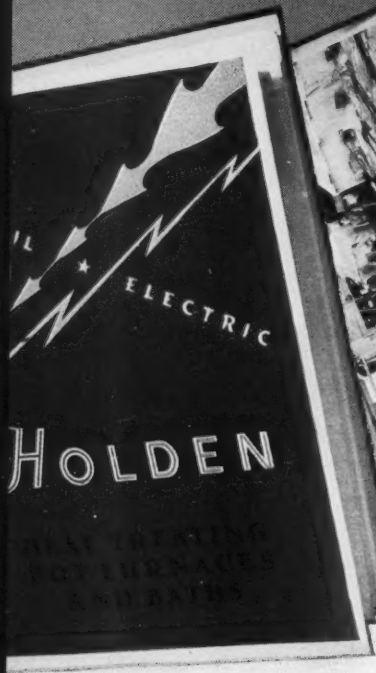

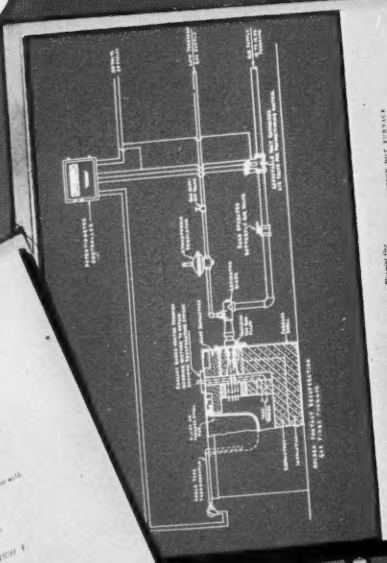

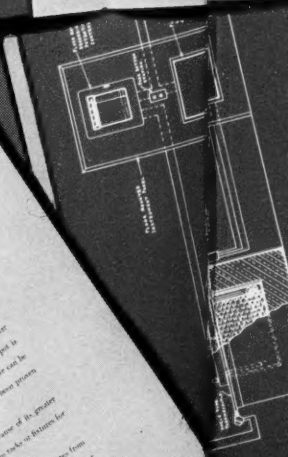

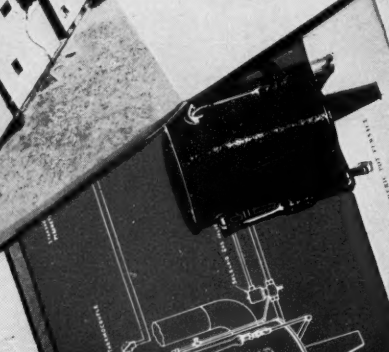

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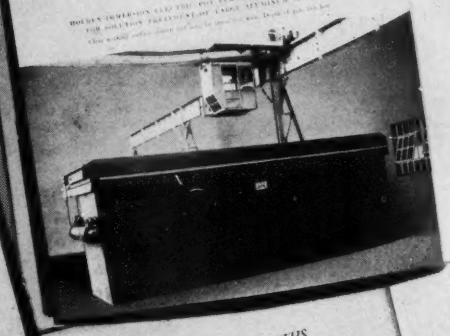

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Peck's Bad Boy And The War Effort

By Dr. Charles Copeland Smith,

National Association of Manufacturers,
New York, N. Y.

An address delivered before the Annual Luncheon of the Wire Association at the Hotel Carter, Cleveland, Ohio, October 13th, 1942.

PECK'S Bad Boy has become the pride of the family. American Industry, having been in the dog house for, lo, these many years, is now the star performer of the home theatre, exceeding all its own expectations for itself and absolutely destroying, for our time, all fear of a destruction of the system of Free American Enterprise; that is, if the American people can continually be made aware of Industry's contribution to the war effort.

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THERE is no doubt about our having been in the dog house. Industrialism was accused of every crime in the calendar, from outright murder to petty larceny. We were accused, on the one hand, of making employment impossible by the increasing mechanization of industry. On the other hand, we were accused of pinch-penny policies which robbed the men employed of the just rewards of their toil. Politicians used industrialists as their 'Exhibit A' of what would happen to all of the rest of us if we were not careful. Industry was the drum that took all the lickings, whatever the tune some politicians wished to play.

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THAT we stayed in the dog-house so long was chiefly our own fault. The American people are still the American jury. Industry too often stood silent before the Court while starry-eyed visionaries, Labor leaders and others gave the contrary evidence. Then, too often, we blamed the jury for bringing in a verdict only in accordance with the evidence it had heard; though it had been our own fault that the jury had not heard our side of the story.

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LATELY, however, we have changed our ways. The National Association of Manufacturers and similar organizations have lately taken pains to make the public acquainted with some of the facts—the facts concerning Industry's contribution towards the making of America. Facts, not propaganda, were needed. Facts, not propaganda, have been given.

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THE facts are enough. Every time I go home, I take down from its shelf my favorite volume of the Five Foot Shelf—the volume containing the speeches of Abraham Lincoln. Of course, I read again the Gettysburg Address and the Second Inaugural. (Would that we all made that a weekly exercise, these days). But there is another little speech of Lincoln's with which we are not too familiar; the little talk he gave to his neighbors and friends of Springfield, Illinois, as he left for Washington and the White House and his martyrdom. That talk to his neighbors was delivered only eighty-one years ago — just two lifetimes ago. Yet, in that speech, Lincoln referred to "this great nation of forty-million people." Today, we are a nation of one-hundred and thirty millions of people—after only two lifetimes. That is the most amazing story of national growth in human annals.

DR. CHARLES COPELAND SMITH

An Englishman by birth and naturalized as an American citizen in 1919, Dr. Smith in the last war was appointed by the Hague Convention as an Industrial Supervisor for Internment Camps and organized employment for prisoners of war. For many years he wrote a daily column on social subjects for the Chicago "Daily News" and has been active as a sociologist, economist, author, radio commentator and lecturer.

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HOW did it come to happen? It happened because the American spirit of adventure, having conquered the unconquerable mountains and having forded the unfordable rivers, had come to animate American Industry. The modern American industrialist is the true son of the pioneer. He is still conquering other unconquerable mountains and fording rivers, thought to be unfordable until now. To use the opportunities which his creativeness, his inventiveness provided, America had to reach out to the far corners of the Earth for men to use the opportunities American industrial genius had provided. That is how modern America was made. Why has American Industry been so silent concerning its own enormous contribution? Every church, every school, every professional man in America—in excess of the needs of Lincoln's forty million — owes its or his opportunity to the openings provided by Industry. Our chins have been too near our collars. Let us be just a trifle boastful, in future, concerning our chief by-product. It is modern America.

AND now, the call has come to American industry to defend the America which American industry created. How are we getting along with that job? Well! It's the same sort of story—only more so. We have the fightingest fighting men in the world. But their courage and training would have been a vain sacrifice on the altars of world agression if it had not been that the courage and the training had been backed up by the productivity of American industry. The experts have invented a new word for this sort of thing. They call it 'logistics.' Don't let the new word obscure the fact. Our American secret has just been the old one of adventure interpreted in terms of almost unimaginable industrial inventiveness and production. General Motors have just announced that their aircraft engines division is everywhere producing 50% more engines than a year ago. But that is only a single instance of what is proving true in every branch of Industry. The whole automotive industry of America is nearly 50% ahead of schedule at this moment. And not only the automotive industry. Take steel. Our steel industry was the wonder of the world when our annual output stood in the neighborhood of 60,000,000 tons per year. Since Pearl Harbor, there have been several months when our monthly output of steel has been in the neighborhood of 7,500,000 tons. Multiply that figure by twelve and see what you get! Mr. E. T. Weir has recently stated that just one steel-producing corporation (United States Steel) is today producing more steel than the whole of Nazi Germany and the whole of Nazi-occupied Europe. Let us put that one fact in our pipes and smoke it to the bottom of the bowl!

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TAKE another fact! Our scrap shortages have given us deep concern lately. Yet even that shortage is a tribute to us. The new aircraft carrier 'Lexington' was launched, the other day. It was launched two years after the keel was laid, instead of the scheduled three years. That means that in two years, we used three years' worth of steel. No wonder we have a scrap shortage! But our shortage is our tribute under such conditions. I am reminded by all this of the story of the Red Cap holding the great dane dog. He was asked where the dog was bound for. His answer was, "Mister—none of us 'round here know that. You see, he's swallowed his own labels." I believe it is like that with American industry. It's no use setting goals and speculating on so-called 'saturation points.' Give the industrialists of America the oxygen of freedom in which, alone, their spirit of adventure can exert itself, and there is no telling where they can go or how fast they can travel. Government direction to the industrial war effort is necessary. It is inevitable. But to get the best out of the Adventurer in any age, you must restrict his freedom as little as possible. Where I come from they have a saying about 'letting the dog get a look at the rabbit.' Once he is free to do that, you can rely upon him to make the race.

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AND, of course, that raises the question of the Day After Tomorrow—the day after Peace is declared. What are we doing to prevent it from just becoming 'the morning after the night before?' How greatly have we to fear its dawn? What will be the length of the slack to be taken up if our people are to be adequately employed and our national income maintained?

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INDUSTRY'S answer is that only two factors need to be kept in mind concerning that. First, they ask no profits during the war emergency. At least, they ask only the smallest minimum of profit. But it is necessary that government allows industry sufficient of what are called 'basic credits' to enable us to replace the billions of dollars' worth of machinery that is becoming obsolescent three times faster than in Peacetime, at least. Without the power to buy or make the machines of tomorrow, American industry will be stymied in its task of making employment for Tomorrow. By its tax contribution, Industry is making a contribution to the war far in excess of all the individual income tax payers of the nation—and is glad that it is so. But it is vitally necessary that, in its desire to pay for as much of the war effort as possible, the government do not rob Industry of the wherewithal for providing the means by which, tomorrow, America may take up the tasks of Peace.

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THE other necessity for the Day After Tomorrow is that American Industry summon all its inventiveness today in order that new processes and new products may be ready when Tomorrow calls. **Dr. Carl Compton** has, for two years now, been chairman of a committee of researchists and inventors, created by the National Association of Manufacturers to forewarn Industry of and to forearm Industry against the problems of the Peace. That Committee has reported that so many new products and processes may be ready for the market—or, at least, for the manufacturer—that there need be no slack to be taken up, at all. Research, invention and the manufacturing energy necessary to put the research and inventions into effect are ready now. Industry has met the call of Yesterday. It is magnificently meeting the call of Today. Let us be assured that, if it gets the 'go' sign from Congress and the Administration, it will more than answer the call of the Day after Tomorrow, also.

If You Are Not A Member Of The Wire Association—Now Is A Good Time To Join!
The Annual Dues Are $10.00—For detailed information address
RICHARD E. BROWN, Secretary
300 Main Street THE WIRE ASSOCIATION Stamford, Conn.

Alloy Steel Program For 1943

With essential requirements for alloy steels during 1942 estimated at more than double the 1940 consumption, the War Production Board is engaged currently in a broad-scale program to assure an adequate supply of these metals, essential in every phase of our military program. ✦ ✦ ✦

AMONG the major steps undertaken by WPB to fit the essential requirements to the supply has been the development of National Emergency alloy steels. Seventeen steel producers have been given permission to ship experimental amounts of the emergency steels to laboratories or manufacturers during the fourth quarter.

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WPB has moved in other ways to solve the alloy steel problem. In conjunction with the industry and with technical groups, WPB has speeded the combination and substitution of the more plentiful alloying elements for the scarcer ones.

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PROGRESS also has been made in expansion of production and imports. Next year, for instance, chromium production in the United States will be nearly 250 times as large as the output in 1940. In 1941, our supply of nickel was 11 per cent less than it will be this year. Last year we had 27 per cent less molybdenum than we will this year. But still, there will not be enough to meet non-essential demands.

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HAVING adequate amounts of alloy steels is, of course, a prime military necessity. The tools in machine shops retain their cutting edges, and the shells which cut through armor-plate, function only because they are built with alloy steels — steels which are harder, tougher, and in other ways more durable than the steel which is being cut in the machine shop or destroyed on the battlefield.

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THE alloying of steel, therefore, is among the major techniques of the metallurgy of war. Six important alloying metals, properly combined with steel, are used in the production of the highly specialized and "tailored" steels needed for various tasks.

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THE problem of alloy steel supply is complicated by the fact that of the six alloying metals—nickel, chromium, manganese, tungsten, vanadium and molybdenum—all but one come principally from outside the United States. In peacetime, the first three were almost wholly imported.

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BUT despite the fact that the war has cut so sharply into our supplies of these metals, essential requirements for alloy steels have shot up 240 per cent since 1940.

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PERMISSION to ship amounts of the emergency steels will allow for thorough testing of the new alloys in which greatly reduced quantities of critically scarce alloying metals are used. The new series of steels features compositions having suitable amounts of manganese and silicon in combination with the scarce metals to produce steels with mechanical properties similar to the more highly alloyed types.

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SUCH shipments may be made, in limited amounts, without regard to preference ratings. It was pointed out that although the permission extends only to specified companies, any producer who desires to ship the new steels for testing purposes may do so after application is made to the Iron and Steel Branch.

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BECAUSE of the widespread substitution of one metal for another, the six metals should be considered as a group. All of them are scarce, and the requirements of our present munitions program for each are greater than the supply of each. But the shortage of no one alloy metal will be permitted to shut down production. By substitutions, new alloys are being developed and maximum use is being made of alloy scrap.

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THE United States program for alloy steels is co-ordinated with the program of the British Ministry of Supply through the Combined Raw Materials Board.

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FOLLOWING is a summary of the general situation in each of the six alloying steels:

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Chromium

STAINLESS steel sinks, soda fountains, and auto trim are not necessary to winning the war. Neither is chromium-plating on bar stools or store fronts. Stainless steel is about 18 per cent chromium, plating is usually the pure metal.

✦ ✦ ✦

BUT we do need chromium to win the war — for tool steel, for armor plate, ammunition. We haven't enough for both, so chromium has disappeared from the soda fountains, lipstick cases, games, automobiles, and all the thousands of gadgets we've grown accustomed to.

(*Please turn to Page 81*)

FIRTHALOY SPRING-FORMING TOOLS also Have Gone to War

SPRINGS never before had to be so precise, so enduring as now. For, today, they have become an important factor in America's all-out war program. That's why FIRTHALOY Carbide Spring-Forming Tools have the call. They have proved their ability to form WAR-purpose springs to rigid specifications . . . produce excellent surface finish that adds greatly to spring life.

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WIRE ASSOCIATION PROCEEDINGS

Meeting, Monday, October 12, 1942 - 2:30 P. M.

Chairman of Meeting

H. H. Timbers, Contract License Manager,
Western Electric Co., New York, N. Y.

OPENING ADDRESS	Carl E. Johnson	President of the Wire Association
PAPER: "The Wire Industry's Part in Industrial Conservation"	Ivon B. Tilyou, Assistant Utility Co-Ordinator	Industrial Salvage Section War Production Board, Washington, D. C.
SOUND MOTION PICTURE: "Mines Above Ground"		Western Electric Company, New York, N. Y.
PAPER: "Material Conservation"	Frederic Luther	Western Electric Company New York, N. Y.

PAPER: "THE WIRE INDUSTRY'S PART IN INDUSTRIAL CONSERVATION"

The Chairman: We are fortunate in having with us today a gentleman from the War Production Board. This gentleman is not a theorist; he is a practical man who has had a broad experience in the industrial field, particularly in the utility field, and in connection with the wire and cable business of this country at the present time. He is the Assistant Utility Co-ordinator of the Industrial Salvage Section of the War Production Board. I take pleasure in introducing to you Mr. Ivon Tilyou. (Applause).

Mr. Tilyou then spoke on the subject of "The Wire Industry's Part in Industrial Conservation." This address was published in the November, 1942, issue of Wire & Wire Products.

The Chairman: Mr. Tilyou has indicated that he will be glad to undertake to answer any questions you may care to ask provided they are limited to this subject. The floor is now open.

A Member: Mr. Tilyou, we have just finished a salvage campaign down in the Baltimore District and our biggest trouble seems to be in getting rid of the scrap that we've got piled up. There seems to be a profit motive on the part of certain junk dealers that makes it a little difficult to get the thing broken down. Is there anything that can be done along that line to get the stuff moving?

Mr. Tilyou: Yes, there is. I believe Philadelphia has an industrial salvage co-ordinator—I do not have their address with me, but write to the War Production Board, the Production Salvage Section, Philadelphia, and tell them this story. There may be a reason behind it. We are having a great deal of trouble with scrap dealers. In the first place, they are the outgrowth of the old junk dealer, who was quite a fellow to do business with. Fortunately, they have developed to the point where they have a big enough business so that it can't be done on the old principles. It is a tremendous undertaking, to collect and properly segregate and dispose of scrap material to the extent that is necessary today. Offhand, I don't know how many segregations or classifications there are to this scrap material business but there are a good many of them, so that the scrap dealer can make the most money if he breaks it up himself, sorts it out and grades it and sells it according to grade—and the Steel Companies like it best that way because it is ready for use. If it is shipped to them as just a carload of junk the Steel Company has, in turn, to break it up before they can use it. Tell your story to the Philadelphia Chief. Address the Salvage Section, and for the rest of you if you don't know where your Chief is write to me or write to the Industrial Salvage Section at Washington, and we will see to it that in some way or other the thing is straightened out. I will say frankly that those conditions have been reduced to a minimum. As a general rule, the scrap dealers have taken a good licking, too, and they have done a swell job. That is practically universally true. There have been a few cases where we have had to resort to some extreme measures but they have been rare. If I knew more about the individual case I might better answer your question, but I am sure that the Philadelphia office will be your best answer.

The Chairman: Are there any other questions?

A Member: We have a little pet peeve in our mill along that line, too. Every wire mill man knows the scrap hooks that we have for cleaning. They are bronze. Now there is a manufacturer who lives 3 blocks from us, and we used to send our scrap bronze over to him and he re-melted and recast it for us. Now we have to buy new ones from him and sell our scrap bronze to a dealer who is 7 miles away. Why couldn't we ship our bronze and have it re-cast rather than having to take new bronze from this particular dealer—which we have already done because we needed it very badly.

Mr. Tilyou: It is not particularly disgraceful to say I don't know. Frankly, I don't know. Who told you that?

A Member: The Vice-President of our Company. I don't know anything else.

Mr. Tilyou: Has anyone else had the same thing come up? Well then, I am going to answer it this way: It sounds screwy.

A Member: It does. We have about a thousand pounds of bronze scrap and we don't dare do one thing except sell it to one scrap dealer in the City, and he sorts it and sells it back to this other company, if they want it.

Mr. Tilyou: In Kansas City you have a pretty good live man. Go down and talk to Mr. R. R. Andrews, of the War Production Board in Kansas City. I think you will find that Mr. Andrews' answer will be that something is screwy somewhere. After all, Uncle Sam does some peculiar things—he does some funny things with me, too, some very funny ones, but, as a general rule, if you check into it far enough you will find they are reasonable, but that does not sound reasonable, and for that reason I would say it is screwy.

The Chairman: Are there any other questions? (No response). On behalf of the Association I want to thank you kindly, Mr. Tilyou, for your very interesting talk and subsequent discussion.

We have another subject on the program which is quite closely related to Mr. Tilyou's subject, and that is the substitution of materials. The speaker has asked me to state in advance that he will be glad to answer any questions he can and if he is unable to answer them he will frankly tell you so but he will be glad to obtain the answer for you. Mr. Luther is an expert in geneology and ethnology but you may be able to shoot some questions at him along electrical lines that he may want to dodge, and if so I am sure you will feel free to do so. Mr. Luther of the Western Electric Company.

Mr. Luther: I would like to introduce my paper this afternoon with a few remarks. For one thing, as Mr. Timbers informed you, I am not an expert in the substitution program or in critical materials. I am not an expert in telephany or telefonic research or manufacturing. I am a member of the Information Department, which serves as a clearing house for such information as the Company may have of value to other industries or individuals outside the Company. That is, we are given an assignment and we make every effort to obtain full information. For instance, on this paper, the version which is published in the October issue of your magazine has been proved by at least a dozen—I would say between 12 and 16 departments of the Company. Each of those departments made definite contributions to the paper. Consequently our purpose, and my purpose today, is to gather and correlate this material.

I should like to repeat that if there are any questions that you would like to bring up I will make an effort to answer them. I am afraid in most cases they will have to be considered as my impersonal answer, and as such should be off the record. In cases where you stump me I will have to dodge, as Mr. Timbers has said, and obtain that information for you from the proper department.

There is one other point I would like to bring up, and that is to refer back to Mr. Tilyou's talk and emphasize that we realize full well that you Wire Association members represent a great many applications of wire drawing techniques and applications. We in Western Electric are interested primarily in wire from the electrical and conductive standpoint, and, therefore, I think you will find that our paper deals almost exclusively with that characteristic of wire.

Mr. Luther then read his paper which was presented in full in the October 1942 issue of Wire and Wire Products.

The Chairman: Gentlemen, that concludes our program, unless you have some questions that you would like to ask Mr. Luther. I didn't mean to cut him off at the end of his talk.

Mr. Tilyou: If there are no questions I would like to steal two minutes to pay a compliment to the Western Electric Company and to Mr. Luther and to our Chairman. I hope you won't misunderstand me. I am not saying that other industries aren't doing plenty also, but probably there is no one who has made a bigger contribution in scrap than the Western Electric Company. In the first place, they have had the opportunity to do it. They are the biggest base for smelting and refining — it covers the biggest zinc industry in the world. They do all the salvage work for the Bell Telephone, what work is done, and the cooperation they have shown the Industrial Salvage has certainly been a wonderful thing. They have turned this picture over to us, to use it whenever we want to, and we are using it all over the United States. Thank you.

Meeting, Tuesday, October 13, 1942 - 9:30 A. M.

Chairman of Meeting

Earle H. Thomas, Superintendent,

George W. Prentiss Company, Holyoke, Mass.

PAPER: "Reducing Accidents in Wire and Wire Products Operations"	R. H. Ferguson, Manager of Safety	Republic Steel Corp., Cleveland, Ohio
PAPER: "Scheduling and Planning the Wire Mill for War Production"	L. D. Seymour, Assistant Works Manager	Canada Works, Steel Company of Canada, Ltd., Hamilton, Ontario, Canada

PAPER: "REDUCING ACCIDENTS IN WIRE AND WIRE PRODUCTS OPERATIONS"

The Chairman: We have been somewhat delayed in getting this meeting under way, and without any further ado I would like to introduce Mr. R. H. Ferguson, Manager of Safety of the Republic Steel Corporation of Cleveland, who is going to present a paper on accident prevention and safety in wire and wire products operations. Mr. Ferguson. (Applause).

Mr. Ferguson then presented his paper which was published in the Oct., 1942, issue of Wire & Wire Products.

The Chairman: I am sure that everybody is agreed that that is an excellent paper on safety and certainly pertinent to the situation today. If there are any questions I am sure Mr. Ferguson would be glad to answer them for you.

Fig. 1. The above photograph shows a guard on horizontal rolls of a Sutton Tandem Shape Straightener. The guard is portable and can be removed when it is necessary to get at the horizontal rolls when the machine is shut down. It will also be noted that the bar is fed through a guard made of heavy steel plate to protect feeder's hands from entering rolls. This machine is also equipped with shield guard alongside vertical rolls. The installation of these guards is inexpensive and gives the feeder maximum protection and does not interfere with production.

A Member: What type of safety would you recommend to put on a rod type straightener?

Mr. Ferguson: I wish I had brought some pictures along with me. We are using a combination type safety stop on rod and shape straighteners.

A Member: We have a box with a hinged cover to put the bars in so that a man doesn't have to touch them, and we have a bar across to guide the bar into the rod. We do have accidents. We had one fellow who was twisted right off the thing,

and we have been trying to work out something — you might call it a dead man's switch—and if a man was caught it would stop immediately. We will have to put a magnetic break or something on it.

Mr. Ferguson: I don't think we have found a real satisfactory answer to that yet but the information in Figure 1 on shape straighteners will be of interest.

A Member: It seems like a hard one to make foolproof.

Mr. Ferguson: We developed this one in one of our plants in the Middle West which I think is a good device.

A Member: How often do you have these safety meetings, and who is the committee composed of?

Mr. Ferguson: In our type of organization—let's take a type of plant of say 200 or 300 men. A Number 1 group must be the top supervision of that plant. I am talking now about the plant manager. He will meet with his foreman or department heads, whichever way set up, once a month on safety. Likewise this same group will have an operating meeting—perhaps an operating planning meeting once a week, and safety is the first thing discussed in that meeting. That's No. 1 phase of it.

The second phase: We expect every foreman to meet with his men on safety at least every thirty days. In most of the plants those meetings are held once a week, and in many places a foreman will meet at the start of the turn, to check up on certain fundamentals, for 2 or 3 minutes. This first meeting, that is, top supervision of the plant meeting will last for probably 30 or 40 minutes. It is a definitely planned business meeting and it follows a definite program so that it doesn't drag on for an hour or so. With a foreman and his men on a job lots of times we find out that the foreman isn't quite so adept. In such a case we plan these programs in advance: we suggest certain things that the foreman may talk about in these meetings to the men—certain specific things on the job. Now these discussions —and I used the word "help" advisedly because we are not trying to take the foreman's initiative but he may need help at the start. Later he will have plenty of things to talk about after you get him interested, also the man on the job has a chance to talk to the supervisor, but we don't wait for safety meetings for safety practice.

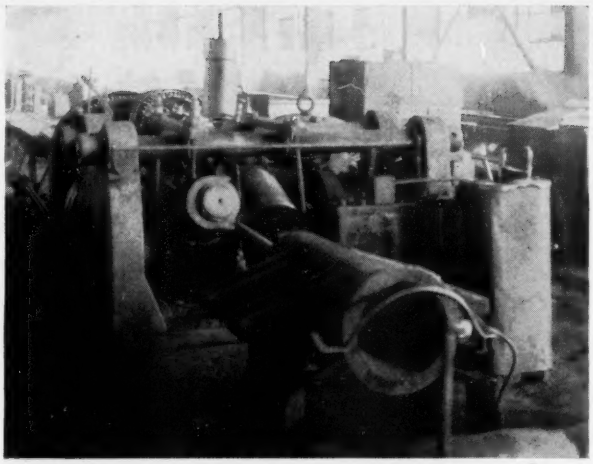


Fig. 2. The above photograph shows switch lever at bell housing and just above entry rolls on #3 Medart. This machine is also equipped on delivery side with a push button stop so that in the event the operator is working on delivery side and trouble develops he can shut down the machine. In the event that the operator should get caught on a bar, a slight pressure against the switch lever stops the machine instantly. The motor of this machine is equipped with a Shunt Brake and the cost of installation is approximately $450.00. This provides maximum protection for the operators on this type of machine. ✦ ✦ ✦

A Member: Right along that line, what is your practice in regard to the payment of the men who are on tonnage or piece work during safety meetings. How long are those meetings?

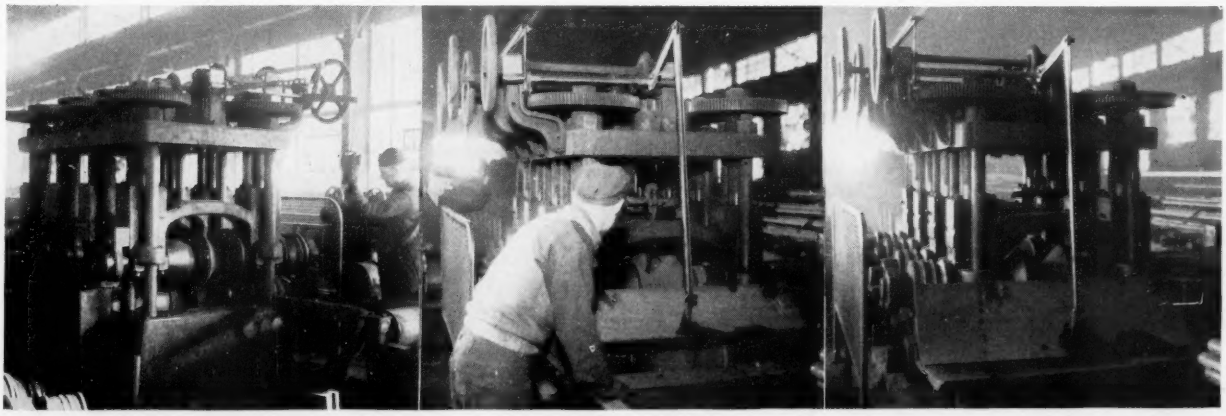
Mr. Ferguson: The man is taken off the job, of course. As I say they are not long drawn out meetings. Where a foreman has a meeting with his men it may last for 5 or 10 minutes, and it may not last that long. There is no loss to the man as far as these meetings are concerned, and, understand, these meetings are held on the company's time.

A Member: What do you consider the most effective type of safety stop for the old bench wire, bench job? I don't mean the modern machines.

Mr. Ferguson: We have gang operated benches with a safety that is actuated by the control as the wire passes into the block. We are using that safety from an operating standpoint, and can shut the entire bench down. (See Figures 4 and 5).

A Member: I would like to inquire as to what procedure you recommend for instructing new men who come into the plant, green men?

Mr. Ferguson: I am glad you raised that question. I think a lot of us have felt—and I have had that question asked repeatedly but we can demonstrate that it isn't so—that a lot of increased frequency and severity today is caused because new people are coming on the pay-roll. If you check you will find out it isn't true. We have a regular procedure that when a man comes into the hospital we give him a physical examination. This is done in the case of all employees. Safety is discussed with him and the doctor has an idea as to what kind of a job that man may go to. In such case we are thinking in terms of placement. The next move, after he fills all the employment procedure—is the booklet "Instructions to New Em-



NO. 1 No. 2 No. 3

Fig. 3. The attached photographs show Kane and Roach Shape Straightener with guards installed. Photograph No. 1 shows operator at the discharge end. He has his right hand on the only control of this machine. His left hand controls a shield at the entering end as shown in Photograph No. 2. The shield when lowered as shown in Photograph No. 3 prevents feeder from entering a bar. After the shield is raised by the operator and the bar is entered by the feeder, the shield drops down on the bar and prevents the feeder's hands from being drawn into the rolls of the machine as they will be brushed off before coming in contact with rolls. The mechanism as shown in No. 1 is counter-balanced so that a slight pull on the lever will raise the shield. Photograph No. 1 also shows the space between the machine and roll table guarded so the operator cannot cut through between machine and rolls while the machine is in operation. Photograph No. 3 also shows screen guard to protect the men against revolving shafts. The cost of installing these guards is very inexpensive and they have not interfered with production in any way. ✦ ✦ ✦ ✦ ✦ ✦

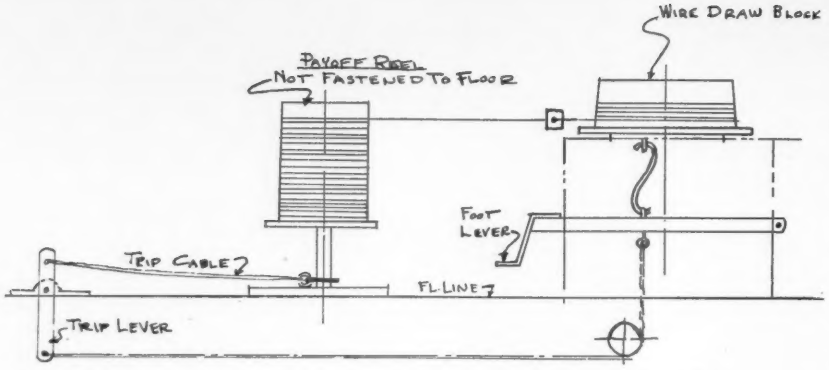


Fig. 4. Schematic Diagram of Automatic Snag Shut Off on Wire Drawing Finishing Block.

ployees". It consists largely of our policy on safety and conduct. He understands exactly what the policy is. The foreman checks him on that. The old way we used to do it—and we are coming back maybe to some of that, where when putting 10 or 15 men on a pay-roll the first thing they are talked to about before they leave the employment office are these instructions on the safety policy. The foreman talks to a man of the specific job or the hazards particular to the job, and explains the safety rules to him. This gives the man a chance to ask questions. There is also a form that the foreman must fill out and the man signs which indicates that he has instructed the man on departmental rules, safety rules. That's the start, and then the man filters right into the regular safety program.

A Member: How far can you go in enforcing these instructions? You speak of a new man being careful, careful about lifts going over, etc., but after awhile he gets accustomed to it and he starts taking chances. The foreman cautions him and then cautions him again. How far do you go with that, and how far can you go with penalties to enforce it? In the old days it hit his pocketbook.

Mr. Ferguson: If your supervision is sold on this matter of safety, and your boss is sold on this matter of safety you won't have that difficulty. Some of us, after all, do make mistakes. We are dealing with human individuals in these plants, but if you have a man—let me ask you this question—if you have a man continually violating the safety rules and instructions, wilfully doing it —I don't mean making just a common run-of-the-mine mistake but wilfully doing that, flaunting it in the foreman's face—he is doing a lot of other things in your plant that he shouldn't be doing —and let me ask you this question: If that man were spoiling a lot of steel in your plant after the foreman had carefully instructed him, and he continued to do that, what would you do about it? You woudn't keep him on the job, would you? Well, the same thing applies to safety. Sooner or later that man will not only hurt himself but 2 or 3 other men with him. We insist on enforcing our safety rules.

A Member: Do you supply prescription type goggles to the men?

Mr. Ferguson: We furnish standard equipment. We do not furnish prescriptions. We have a rule and regulation that wherever eye protection is required we furnish standard equipment. If a man wants prescription goggles, if he will furnish his prescription we will go to one of the big optical companies, and have the goggles ground to his prescription. He paid for his own examination, then he pays for this prescription, and we deduct the amount of the goggles. The goggles we give him at cost. That's interesting if you are interested in prescription goggles, and to a lot of the older men it is important. Instead of buying with these optical outfits where your glasses may cost $15, or $20, or $25, you could buy these prescription ground goggles for your men. It is a fine piece of equipment, ground to his own prescription and costs $5, $6, or $7, sometimes a few cents more, but in your position you can buy through these companies—you can buy safety goggles for your men at a greatly reduced cost.

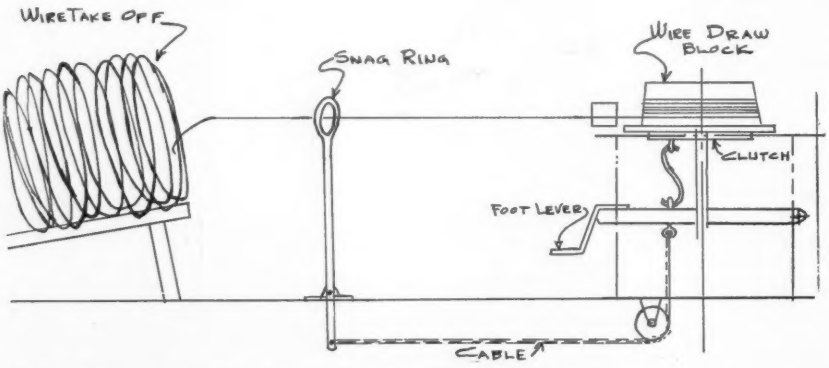


Fig. 5. Schematic Diagram of Automatic Snag Shut Off on Wire Draw Benches.

A Member: Might I ask you this question? How closely do you relate accident cases with the industrial health of the individual or the home life of the individual?

Mr. Ferguson: If you have hazards that are, let me say, detrimental to the health of the men, then you should do something about it.

There are two phases of your question as I see it. I think, to get to No. 1, we should make our jobs as safe and efficient as we possibly can, and not only safe from the standpoint of health but from the standpoint of occupational diseases—and you are going to hear more about occupational diseases in the months to come. I might add that in our organization our plants are checked for industrial health hazards at regular intervals by a regular crew that studies this. We know what these hazards are and correct them.

Second, in regard to a man's home environment — if a man's environment isn't right his attitude toward his job isn't right. When a man comes to a job you can rarely see what kind of an attitude he is going to have on that job, and there are various other factors, psychological factors that produce these mental factors.

After all, you can study this thing but what can you do about it?

A Member: I would have liked you to be a little more specific but I am very glad to have your answer. What I would like to see come out of this inference is that the foreman or the superintendent should take a more personal interest in the actual physical condition of the men working for him, and in that personal relationship he will get closer to the individual and have that individual get a better mental balance toward his job, and that I believe will reduce the hazards.

Mr. Ferguson: I think you are 100% right. In the first place, let me say this—I found this not so much in our smaller plants but in our larger plants, but this example is interesting. We have a situation in one of our big steel plants where each foreman in that Labor Dept. meets his men for 2 or 3 minutes at the start of each turn. He checks their shoes, checks their goggles and checks their tools that they are going to work with, and at the same time he checks as to how a man is feeling on the job; he knows if a man is feeling all right or whether he is in bad condition. The foreman is faced with this particularly after pay day when men come in on the job absolutely unfit to work, so it is the foreman's responsibility to know the condition of the men. He certainly does have to know when you get into this factor of fatigue, when they have to work sometimes many hours overtime.

A Member: I just wanted that thought to come into our minds, that we have got a more personal responsibility to our neighbor who works for us and a leadership to it. I was going to say that this course we have is more or less interested in breaking down the job and getting

the men quickly trained for the task in hand, and it brings that person side by side with leadership, and I feel in safety work that we have got to have that safety approach. It is so interlocked with the welfare of the individual and the general morale in the area interested, it brings in a lot of Christian possibilities, rather than taking too materialistic a view of this thing, and in that way I think you uplift the morale greatly.

Mr. Ferguson: I think you do create an understanding between a man and the foreman. After all what we are trying to do is to increase efficiency and eliminate all our inefficiency.

A Member: We are breaking in girls on grinders, where we had men before, and the girls are complaining about their hands. Lime and the soap powder does bother their hands and they get quite sensitive on the tips of their fingers. Is there anything we can do to help that?

Mr. Ferguson: From a practical standpoint there is one thing I would like to see you try, and that is one of the industrial ointments—there are a half-dozen of them — ointments and creams. We have to use them in some places where we run into dermatitis. You put it over the hands to protect them, and you can take it off with soap and water. Do you have a lot of liquid on that job?

A Member: Yes.

Mr. Ferguson: Why don't you try it? They are all splendid and will do the job to a certain extent.

PAPER: "SCHEDULING AND PLANNING THE WIRE MILL FOR WAR PRODUCTION"

Mr. L. D. Seymour then presented the above paper.

The Chairman: The meeting is now open for questions.

A Member: I think Mr. Seymour should be complimented on the very excellent presentation of a problem that has been bothering a good many of us. I had one question come to mind that referred to results. I had a note here in regard to break-downs. I assume they are handled in the same way, that is, absorbed by the 20% cushion. What is going to happen if a break-down is so serious that you exceed the 20% that you have available? My point is do you re-schedule those orders that are missed on the tail end of the process or do you slide the whole thing on?

Mr. Seymour: That is taken care of by referring to the master schedule. If you will notice, on the master schedule we have allocated all orders by machine groups. For example, we may have a 14 block bench that breaks down. We will call it No. 2 bench—if No. 2 bench breaks down you schedule stops there until it is repaired, in which case you would have to notify the customer that you are faced with a delay beyond your control and that your promise can't be met. By keeping the orders assigned to individual equipment a breakdown or other delay would not throw the whole schedule out of gear—you just throw that one column out of gear. In lots of cases where you have enough equipment part of it can be carried on the 20% cushion with some other equipment.

Same Member: Do you find that you could take some of those jobs that are going to be missed and put on other equipment?

Mr. Seymour: We try to do that as much as we can.

Same Member: How far ahead do you try to schedule along that plan?

Mr. Seymour: Only as far ahead as raw material is available. We don't schedule the orders if we don't have the rods right on the spot. We keep those orders out of the mill because all they do is confuse the issue. We only schedule as far ahead as we have rods or other raw material to proceed with.

The Chairman: That is an interesting statement. For some time I've been trying to convince our Sales Department but as yet we haven't been able to find a way of withdrawing promises.

Mr. Seymour: I have been expecting a question about that. The other day a couple of gentlemen came up to Hamilton to see us about scheduling, and the first question they asked was, "What do you do if the Sales Manager calls up and says, 'One of our special customers is on the phone. We have been selling him for 25 years and he's got to have some wire tomorrow and the Mill tells him that he is not going to get it for four weeks.' What do you do in a case like that?"

Well, for one thing you have got to have a co-operative Sales Department to make this thing work. That's one thing, and the other thing is you have got to get your complete commitments down there on one sheet. It helps considerably to be able to lay your schedule on the Sales Manager's desk and say to him, "O. K. We will be glad to help this customer, but you scratch off the order you want us to replace. If you haven't got it all on one sheet it is very difficult to pin the Sales down as to what will suffer by giving the special customer priority. Where you have a master schedule and can lay it before him on one sheet you can say to the Sales, "All you have to do is to tell us what to scratch off," and pretty soon they get to the point where they know that they are not going to get very far in approaching the mill with such a problem.

A Member: Mr. Chairman, Mr. Seymour has presented a very difficult problem of wire production in a most admirable way. There was one feature he brought out that I have never seen before, and that was the fact of scheduling by weeks. I would like to ask him if with all the orders going through the mill whether the weeks go through on all the orders as scheduled.

Mr. Seymour: As near as possible, yes. There are occasions where breakdowns or rejections, or something like that, don't go through, but after this scheduling has been tried out, and it has been working for awhile, it is remarkable how easy it is to get the wire shipped when it is promised. I say that because every department knows exactly when they are going to get their material. Some of our promises may seem to be extended a little bit. In other words, before the war we probably would get out an order in 3 weeks where now we promise it in 4 weeks. We also have a procedure which I failed to mention in the paper. We have a small inquiry form and when an inquiry is received a form is filled out and each departmental schedule is consulted and a tentative promise built up. By having the scheduling and planning procedure all centralized in one place you can do that because you know exactly what you have got against each department in the mill, and by having this 20% cushion, lots of times you can beat a promise, where it is essentially important. On the whole, I would say that it works very well, because you are doing it all at one central point and not leaving it up to the foreman. After all, the foreman, being a human being, likes to do the easy jobs first and the hard ones he will let go.

Same Member: I would like to ask if No. 1 week schedule starts, let us say, and it is delayed a week. Does that No. 1 still stay there until it is completed?

Mr. Seymour: No, on the production tickets that may start out on the schedule as No. 1 week; it goes into the annealers as No. 2 week and it may go into the re-drawn mill as No. 3 week and so on through. The numbers of the weeks are changed as they move from one department to another. We merely use those numbers for weeks so that there is not so much writing to do. Instead of writing out the date, or the week of October 10th, we just use the number of week.

Same Member: One other question: You know your tonnage for the month. What I want to do is to get a basis of the number of men involved in a scheduling system of that type with your definite tonnage a month, and looking over the field just broadly how many men would you say your system involved?

Mr. Seymour: That's rather a hard question to answer. I might say that when we started out on this program the fellow we gave the "Go Ahead" signal to, to develop this thing—and I might say what we have now doesn't look anything like what we started with; we discarded a lot of forms and we may discard some more of them yet—when we started out we gave him a blanket order to take as many men as he needed. "If it takes two men to schedule every bench go ahead but get the thing organized and we will talk about economy after." We are now

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Resistance Wire

Nickel Silver.

Weaving Wire

Bronze (Antique Golden), Brass, Nickel Silver, Ambrac, Everdur*, Phosphor Bronze, Copper and Fourdrinier Wire.

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going through the procedure of cutting off the extra help. We now find duplication and waste motion, and we are cutting that down, but on a wire mill the size of ours we hope to have a production office of about 5 or 6 people doing all the scheduling.

A Member: What is your average tonnage?

Mr. Seymour: I would say on 4,000 tons of rods drawn a month it would take 5 people to schedule it. It may take more depending on how fine you are drawing.

A Member: Mr. Seymour, what provision do you make for scheduling your mill in accordance with priorities AA1, AA2, etc., and how far ahead do you schedule, and how often do you put the new AA1's ahead of the AA3's and lower ratings that you may have on the books? That's a problem.

Mr. Seymour: Somebody asked me this morning if we had been mixed up in this AA1. We haven't got quite as many priorities as you have here in the States, but oftentimes in the best, AA1, we haven't got the rods available but we may have in AA2, but we are not going to shut down the mill and wait for rods for the higher priority. It more or less depends on what raw material is available. If we have raw material available then we have to try to schedule the orders as near as we can judge by the importance to the customer. There is a lot of guess-work in this, but the only thing we are really pushed hard on for extra special priorities are certain orders which we get directly from Ottawa where we have to give a certain order preference over every other order, otherwise they have to take their turn. It is up to the mill's judgment as to when they will get them out.

A Member: How far ahead do you upset the schedule to take care of those orders? Aren't you allowed a certain number of days?

Mr. Seymour: That's where that 20% cushion comes in. You will find that that is the secret of the whole success of this scheduling. Each week when we make out the master schedule we put down the maximum production. For example, of an 18 block bench in whole tons, and right under that in red pencil, we will put down 80% of the capacity and deduct each order applicable for that equipment from the red figures. On Monday morning of the week in question, we find we have only got 80% to run for that week. We will move up the same part of the next week's schedule and substitute it, and on Tuesday morning if we find one of these occasions that you were asking about, a special priority, we leave that 20% open for that particular rush order. The 20% cushion is a day to day proposition with the foreman of the department involved.

A Member: I would like to ask Mr. Seymour, which is in parallel with the previous question, how far ahead do you requisition rods in order to carry out those schedules, also why do you maintain weekly schedules instead of monthly? Don't you keep your production schedules by the month?

Mr. Seymour: We do as far as rods are concerned. When I speak of weekly schedules they relate to the raw material that we already have in the mill.

A Member: You must at some time indicate the amount of rods ahead. That has to be done ahead of time. In other words, you can't live from day to day; you have to do something which would indicate the quantity of rods a man wants to order. You didn't bring that out.

Mr. Seymour: There are "No Rod" orders. These "No Rod" orders are used to build up rod rollings. If the raw material is not available the orders are given to the raw material control clerk, who checks against his card index, and if he doesn't have it available he uses that as a basis for building up his rod schedule. The reason I didn't mention that was because some of these people here have their own rod mills and they tie the two together while others buy rods from the Steel Companies. From these "No Rod" orders we build up a rod schedule a month or two months in advance.

We are allotted a certain tonnage of steel per month and we build up our rod orders on that basis a month or two months in advance. We are working on December rod orders now. We take those rod orders which we haven't already scheduled on the rod mill or haven't the raw material available for, and we are building up rod orders for December on the basis of priority.

A Member: In other words, about two months ahead?

Mr. Seymour: Yes.

A Member: How does the weekly schedule fit in with your monthly schedule?

Mr. Seymour: When the Rods arrive on the scene then we immediately put them on a weekly schedule. A weekly schedule only works on material that we have right on hand to go ahead with. We know, for example, now that we are going to order a certain low carbon type of rod for a certain order for the month of December, and we know that it is going to be rolled sometime in December—we will get it before the end of the month. Then we will possibly put that on the schedule for the first week in January—No. 1 week on the schedule for next year—as soon as we know it is there or that it is available.

A Member: How do you handle the distribution of soap to wire drawers?

Mr. Seymour: I might say that we turn our lubricants over to the foreman of the die room. He is in charge of all lubricants, and he has a man working for him who distributes the lubricants to the different wire drawers. The type of lubricant, as you may have noticed, is placed on the production ticket and that responsibility is the die man's responsibility. We hold him responsible to get the maximum life out of the die, so we give him charge of the lubricants so he can make sure he gets the maximum life out of the die.

A Member: May I ask does each wire drawer get as much as he wants or just a certain amount for the job, and does each, in turn, get their allotment of soap?

Mr. Seymour: No, the die man gives him a box of soap and if he has any left over when he finishes that order—he may be changing from one type of lubricant to another—when he finishes the order he returns what lubricant he

has left back to the die man who takes charge of it. Does that answer your question?

A Member: Yes.

A Member: May I interrupt just a minute? I did see an outfit at one time that had a very clever system for soap distribution, and that was having the soap all weighed out to be sure that he only used one lubricant. All soap was weighed out in two pound paper bags and the wire drawer came and got a two pound paper bag, and he was checked up once a day to see that he had no loose soap around the box, and as he needed more he had to have a clean machine before he got his next two pounds. It was a small mill and only one lubricant was being used, which made the thing different in many ways from one where you are using grease and using soap and using 101 compounds for different finishes, and such things as that, in a multipe mill, but the system that Mr. Seymour spoke of —having a die man—that was a clever move.

The Chairman: Any further questions? If not, I think we will call this meeting adjourned.

The meeting then adjourned.

Meeting, Wednesday, October 14, 1942 - 9:45 A. M.

Chairman of Meeting

Dr. S. A. Braley, Chief Metallurgical Field Engineer, Pittsburgh Steel Company, Pittsburgh, Pa.

PAPER: "Trouble Shooting on Bronze and Steel Weaving Wire"	**L. D. Granger, Asst. to Vice President**	**Wickwire Spencer Steel Company, New York, N. Y.**
PAPER: "Cemented Carbide Manufacture and Applications"	**A. MacKenzie, Vice President Charge Manufacturing**	**Carboloy Company, Inc., Detroit, Michigan**
PAPER: "Welding Electrodes"	**Dr. John W. Miller, Metallurgist,**	**Reid-Avery Company, Dundalk, Baltimore, Maryland**

PAPER: "TROUBLE SHOOTING ON BRONZE AND STEEL WEAVING WIRE"

The Chairman: The meeting will please come to order. I have been asked to preside at this meeting in place of Mr. Farnsworth who was supposed to be Chairman of the meeting this morning, but he was unable to be here today and consequently I am trying to pinch hit for him this morning.

We have a little change in the program in that the first speaker this morning will be Mr. L. D. Granger who will speak on "Trouble Shooting on Bronze and Steel Weaving Wire"—Mr. Granger of the Wickwire Spencer Steel Company of New York.

Mr. L. D. Granger then presented the above paper.

The Chairman: Mr. Granger's paper is now open for discussion. Are there any questions you would like to ask Mr. Granger?

Mr. Lewis: I have had some interesting experiences with bronze wire and with weaving wire, and from the conclusions I sometimes agree with Mr. Granger and sometimes I don't.

Mr. Granger and I got into wire — in fact, fine wire—about the same time—back about thirty-five years ago. He stuck with it: I couldn't take it. You may remember in those days the only proper lubricant for fine wire was a good rich ripe rye meal liquor, which had sort of an aroma to which I was allergic.

The first time I went in the fine wire department I thought 5,000 babies had vomited on the floor, but finally I decided that someone had experimented with Roquefort cheese and having spoiled the first two or three lots they had buried it in the cellar. But it became necessary for some experimental work to be done which involved my drawing fine wire myself, so I got me a rubber apron and a pair of pliers and drew some wire. I had always noticed that fine wire drawers, when they sat beside me in the trolley car, smelt like a three weeks old corpse, so I, not wanting to take any of that stuff home with me, was very careful to change my clothes and wash very thoroughly after the day's work. But after I had been on that job 4 or 5 days, as I sat at the supper table one evening with my wife, my wife said to me "Darling, you stink." And I did. That stuff gets right under your skin.

I conceived a distaste for fine wire which has never left me, and that's the real reason why the Morgan Company never got into the fine wire machinery. When I got into consulting work I decided that under no circumstances would I have anything to do with fine wire.

But we can't always carry out our plans. A few years ago I was called upon by an old friend—he called me on the long distance telephone and said, "Do you know anything about bronze?" I said, "No." He said, "Do you know anything about fine wire?" I said, "No." He said, "Do you know anything about weaving screen cloth?" I said, "No." "Well," he said, "I think you are just the man we want." He said, "Everybody that knows all about those things has been up here trying to help us and they haven't done a damn thing and I think what we need is a little intelligent ignorance." Well, I protested and I squirmed but I finally agreed to come out and look at the job. I said that while I was hearing the problem laid out I might think of somebody I could recommend. Well, we all sat around in a circle and they told me the story. They told me the things they had done. The trouble, of course, was what Mr. Granger speaks of as washboard and what we out there called tiger stripes—beautiful striped cloth that was just as Mr. Granger described, for the most part uniform dark and light stripes and occasionally a very broad stripe, which, when measured carefully was always a perfect multiple of the normal stripe.

As the problem developed before me it looked so darned interesting that it wound up by my promising to stick with them. I went through, I suppose, the same mental stages that Mr. Granger did. I found out in the first place that the narrow cloth had wide stripes and the wide cloth narrow stripes, and it didn't take very long to figure out that the amount of wire in one stripe was a constant number of feet and a few hours after that it dawned on me that that length of wire, figured back to the size at the last annealing point, was just half way around the bundle. The annealing there was in 12 inch bundles and half a convolution of the bundle contained all the wire in one stripe.

Of course, the first conclusion drawn was that there was irregular annealing. The annealing was done in a round pot, and we had 3 stems. It was a pot, not a bell, and, of course, one portion of the bundle got radiant heat and one portion of the bundle got only what was conducted. (Illustrating on blackboard.).

We had an atmosphere but it was not possible to circulate the atmosphere because it was a top closed pot, but I didn't think, and I don't think now, that the main difficulty was the difference in temper between the two halves of the bundle. I think it can be proved fairly definitely—and I will speak of it a little later.

I will say now the conclusion I reached was that the difficulty was due to a surface difference between this half of the convolution and that half, and that was only indirectly related to a temperature difference. When you draw a bundle of wire, for instance, on a 12 inch block, and slip it off, it immediately slumps into a bundle maybe 10 inches in diameter inside and 14 or 15 inches outside. If you come to think it over you realize that of each convolution of wire one-half of it has slipped over so that it is on the outside of a tied up bundle and the other half is covered up inside. That means that those two halves of the convolution will get different treatment, will tend to assume a different sort of a surface. In this case the wire was drawn in soap—just like steel; there was a soap and lime film on the wire, and it wasn't hard for me to visualize a drying out, a baking out of that lime and soap film which would be of a different character on the outside than on the inside strands. That seemed to explain to me also the presence of these broad stripes which I can not explain on the basis of a mere temperature difference between the inner and outer sides. You can see that while normally half the convolution would be on the outside of the bundle and the other half on the inside there would be occasional convolutions that would run entierely around as inside wires and wouldn't quite reach the edge. I see Dwight shaking his head. Go ahead and shake, you'll have a chance later.

On that basis we laid out a series of experiments which were predicated on the belief that it was a difference in surface texture. I think there were at least 13 lots of wire that were put through. I won't try to remember all the things we did, but among them we soaked the wire in acohol as it came off the 12 inch blocks so that it would take all the soap and lime coating off, and so that the wire would go into the pot bare, and it gave us a beautiful cloth with no tiger stripes. When I say no, I am speaking comparatively. Everybody of experience knows there is washboard on practically all cloth. It is only a matter of how bad it is and how close you want to look for it, comparatively speaking, but we got a darn good wire from the stuff we had decoated—some of it in warm water using a special soap that was particularly soluble. We also cut the annealing temperature very drastically. We had been annealing somewhere around 1200° and we cut it down to 800 and some odd degrees—the very lowest point that would soften bronze, the idea being that at a lower temperature there would be less of this surface differentiation.

Four or 5 other experiments of a like nature were laid out—I think we had about 14 lots in all, and practically every one gave us a good cloth, very distinctly better than the mill had been making for the last several months.

Then we tried one absolutely conclusive experiment. I said, "Now, fellows, let's go crazy." It always pays to be a little bit crazy in a research of this sort. "Let's put one lot through without any sense. We can definitely trace this difficultv back to the annealing, so the logical thing to do is to omit the annealing. I am ready to concede that it can't be done in practice but it can be done experimentally—let's do it." The cloth that was woven up from that unannealed wire was the most beautiful cloth they had ever seen in the plant. It was perfect, and not only that but it was a darn good cloth in every other respect, and I don't think there has been any annealing of that particular wire at that plant since that time. It not only solved the problem but saved quite a few dollars besides.

I noticed while I was there that a similar difficulty was developing in the steel wire. It wasn't very bad but I found on inquiry it had been sneaking up on them, and I wasn't surprised a few months later when I was called back and told that the steel wire was affected. This was steel, so we couldn't omit that annealing. I still held to my belief—not belief but positive conviction—that the trouble was all in the annealing, and I held to my belief that while there was a temperature difference between the outer and inner half of the bundle that undoubtedly played some part, the difference in the surface probably was of greater importance. I felt that a surface differentiation due to outer and inner coils persisted through the pickling and left the two kinds of surface in a condition to pick up different amounts of copper. That would, of course, tend to make light and dark stripes, because the reflection is due in some measure to the amount of copper on the wire.

Mr. Granger: I thought this was bronze wire you were talking about.

Mr. Lewis: I have now shifted to steel wire. I am on the second phase. Everything is awfully hard to prove in weaving wire but we did one experiment that confirmed, in a measure, my belief that it was surface differences. We drew some wire entirely without copper. We drew a lot of it. It was hard on the dies, of course, but it could be drawn, and a darned good wire it was. We wove it up into cloth, and there was no sign of washboard. We used the same pots, the same temperature—all conditions were the same except there was no copper coating on it and there was no washboard. That absolutely proves that Granger is wrong. In a minute I will prove he is right. You can prove anything in this business.

There is no question that the outer half of the bundle was of a different temper than the inner half. We plotted tensiles and got the same curve that Mr. Granger has described, and there seemed to be enough of difference to make wash-board cloth. It appeared to be due to the fact that we were too close to the pot there (indicating on board) and too far from the pot there (indicating), for we had radiant heat on that half only and conducting heat on that half, and slowly conducting heat at that.

The plant was rather pressed for annealing capacity and was not giving the wire very much of a soak. It was annealing at rather a higher temperature than I thought was advisable, cutting out soak so as to get more wire through the pots. I recommended right away a temperature a couple of hundred degrees lower and a long soak, so that that differentiation of stiffness would be ironed out to a considerable degree. That couldn't be adopted as practice because there just wasn't enough floor space and annealing capacity. But we did it in an experimental way and in a very large measure solved the problem, and it made a very neat cloth. We didn't entirely get rid of stripes but they were pushed back to where the wire could go out to the trade.

There was one obvious thing to do and that was to circulate the atmosphere so as to bring a greater degree of uniformity between the two halves of the stack. We wasted quite a lot of time and gray matter trying to find some way to circulate the atmosphere in a top closed pot, but it wasn't practical; there wasn't room. It was too awkward, so we gave it up and decided to put in the bell type annealing, and when I left I felt we had solved the problem to the extent that we had pretty definitely found out where the trouble was. You can't put in bell type annealing over night but the bell type annealers were later installed and I am told that the washboard in steel wire immediately faded out and hasn't come back.

I might speak of one other weaving wire job that I had. It is unrelated to this particular trouble but just shows what a great variety of grief you can have.

I was called to a mill where the cloth was absolutely unsaleable on account of markings, longitudinal markings on the shute. The wire markings looked like the efforts of some child to train himshelf in the Morse Code. There were long and short streaks along the wire. That's a piece of wire (drawing on blackboard); it would be streaked like that, a short streak, then a couple of long ones, then two or three short ones, and it was very irregular. There didn't seem to be any pattern about it. The nature of the streaks we couldn't determine. When I got to the mill they were winding up a long research that had gone on for several weeks, in which they had investigated every detail in the manufacturing process. They changed their source of raw material several times; they changed the drafting; they changed the lime; they changed the lubricant; they changed the pickling practice, everything that could be thought of was changed and the results observed. Then they changed each back again so as to have a perfect control. When I got there the die people were there and finishing up their checking on the dies. I went over the details but I couldn't see anything out of line. Furthermore, we couldn't find out—we couldn't definitely pin the trouble to the wire, the wire on the blocks or the wire on the bobbins. We couldn't see a trace of this difficulty. It was not easy to see anyway in the wire because it only showed up in the woven piece when you caught the light on it properly, and even in the woven piece it was rather obscure until the cloth had been electro-galvanized. After electro-galvanizing the cloth the Morse Code came out beautifully. The wire on the bobbins appeared to be perfect. It only got the Morse Code after it was woven. Of course, after it was woven and you unwove it and tried to examine it you couldn't put a micrometer on a piece of crimped wire. We got it under microscopes of various kinds, and we nearly

burned our eyes out, but we couldn't make out whether those marks were flat places or scratches. They were just light streaks. It looked so hopeless that I had to pull one of the regular consulting tricks and go off on another job. What I really wanted to do was to get away from the horror of it; I was getting delirium tremens and I wanted to get away for a couple of days where I could think. So I went off for a day or two and then I came back. Before I left I got ahold of the foreman and I begged him very urgently to go back and re-examine his cloth, this Morse Code cloth, and see if he could detect any sort of rhythm in the occurrence because it wasn't uniform. There were spots and then several inches where there would be almost nothing—sometimes a foot that was moderately free from it and then in other places there would be very thick. I said to him, "Now you see more of this cloth than I do, and your eyes are better than mine; go over and over and over it and see if you can spot some sort of rhythm." I came back and he took me aside and he said, "I think I see a rhythm." He said, "When you first put in a bobbin the cloth runs pretty good and as the bobbin gradually empties the cloth begins to go bad, and when the bobbin is almost empty the cloth is terrible." I went back with him and we looked over our cloth, and he was right—the sort of thing that was just obscure enough so it had to be shown to you; only an expert would be able to spot it, but when it was pointed out it was quite clear that there was that rhythm in the cloth.

So we went up to the bobbin room right away and I spent several hours watching the winding of the bobbins. I found that the company had recently adopted a new type of bobbin. We went back and got the old bobbins out and filled them up with wire and put them in. By the way, I am only giving you a short-hand account of this thing; it went on and on and on. We tried dozens and dozens of tricks; I am only giving you a short-hand account. I have to keep it pretty accurate, too, because two fellows are sitting in this room who were with me on that job.

As I say we went and wound up some old bobbins, but it didn't make any difference. I spent several hours in the bobbin room watching the bobbins being filled and I couldn't see any difficulty. I spent I don't know how many hours in front of the looms watching the shuttle travel back and forth, and those looms run pretty fast. All I got out of it was a bad case of shaking palsy. One of the recommendations I left when I went off was to buy a stroboscope that would slow up the motion of that damn loom and we could see what was actually going on. Then I turned my attention to one loom, the only loom in the plant which was making decent cloth. That loom had been slowed down for experimental purposes to 10% of its normal speed and that loom was making nice cloth, and that was the only loom in the whole damn plant that would. Something occurred to me; I said to the foreman, "When you slowed down that loom did you take advantage of the opportunity to overhaul it?" He said, "Yes." Well, I went over to the First Aid Room and got some surgeon's tape. I took one of those bobbins and lined it with surgeon's tape, filled it up with wire and wove some cloth. I still got marks, the same damn marks in the same damn place, but the marks were of a different character; instead of being shiny spots they were appearing rather as dull white streaks—just what you would get by rubbing on a piece of surgeon's plaster with that zinc oxide dust. I said, "Aha", and I then went out to a drug store and got some wide rubber bands and I took one of those bobbins and I snapped one of the rubber bands over each flange, like rubber tires, and we wove up some wire from that bobbin and again we got the same marks in the same places—the same pattern but still a different character of mark—a rather dull dark mark. Then we called the gang all together again and I showed them the samples and told them what I had done. I mentioned that slow loom and I said, "How often do you overhaul these looms?" There was a great silence. I said, "How long since these looms have been overhauled?" There was another great silence. People began to look at each other and grin a little bit. Finally somebody spoke up and said, "You know we have had a very busy year."

The President said, "That's all I want to hear." So we shut down and overhauled every loom—and that was that.

I agree with Mr. Granger in the main, that uniformity is extremely desirable; in fact, uniformity is the great desideratum. We disagree, however, on whether uniformity of temper is more important than uniformity of surface.

I have data that I can submit that would prove one side of the case and then I can talk that data away and pull out other sheets of data and prove the other side of the case. Probably as in so many of these wire mill cases both are largely right.

In connection with this Morse Code another recollection comes to me. We again used a wire without coating and found that it was not marked. The marking, of course, was due to the fact that the shuttle wobbled so much in the shuttle bar that when the bobbin was almost full and the wire was leading off from that top surface, it did pretty well, but as the bobbin got empty and wobbled, the leadoff wire was rubbing against first one flange of the bobbin and then the other. That's why we got interruptions and why we didn't have a continuous streak. It would rub against one edge of the bobbin and then another and as the bobbin got empty we not only had more of that angular drag but the bobbin was going very much faster and we got a higher polish. The polishing was due apparently to the fact that there was copper on the wire.

During the course of the experiments we ran the copper up and down. We put on more copper and less copper and when we got on the wire the minimum of copper we had very much less trouble with marking, but we had more trouble with the dies, and when we got on heavy amounts of copper the markings were worse. Apparently it was the soft copper that took all the grief, and that seems fairly well proven by the fact that we drew bare wire, wove it and had no Morse Code.

The Chairman: We seem to come to one conclusion—at least, we have arrived at one point, and that is down to the annealing point we are alike, but, from that point there seems to be a difference of opinion.

Mr. Granger: I have just four points to make in regard to Mr. Lewis' information—please. Remember this is entirely unrehearsed.

In the first place, I am glad to know in one place they admitted that something was the matter with the loom. That had never happened before.

In the second place, in support of my argument is the evidence of uneven annealing and tensile strength. We absolutely tested the annealed wire and found that the difference in tensile strength from convolution to convolution in the annealed wire was sufficient to cause the difference in tensile strength in the finished wire. In the second place, we put the woven cloth under a microscope and by the adjustment of the focusing device we measured the amount of crimp that there was in the hard wire and the soft wire. The crimp in the hard wire was less than in the soft wire, which would account for the difference in reflection of the light.

In the third place, Mr. Lewis spoke about drawing wire dry, without the bright copper coating. The reflection of light would be very much less, and, in all probability, though the condition might occur, it wouldn't be so noticeable in the dry drawn wire as in the liquor finished or coppered wire which would reflect the light quite strongly.

There may be something in the question of surface, in that a softer wire will take copper in a different way from what a hard wire will, but the result would be then in a reflection of light, and inasmuch as the crimp itself is shown under the miscroscope to be different in the two kinds of wire it is quite evident that the stiffness of the wire is the cause of the trouble.

Mr. Lewis: I agree with Mr. Granger that there is a difference in stiffness. The only point I want to bring out is that is not the only factor. We may differ in our opinions as to whether it is the chief factor or not—sometimes it may be and sometimes it isn't.

Regarding the bare wire, it was not dry drawn wire but the wire drawn in liquor, which took a high lustre.

A Member: Mr. Galloway of the B. Greening Company could tell us something about that—he is here—but I don't know whether he would care to or not.

Another Member: We went through this matter of pattern. We put in the bell type annealing furnaces and at the same time we put in high speed wide drawing machines, and for some reason or other this pattern was noticed quickly. So we looked around the plant and everybody was blaming the other fellow. Finally we decided we were going to try to find out what it was and pin it down.

We started in by taking the wire which gave the pattern and we tested it inch by inch—that is, as far as we could. We took a piece of wire; we cut off our test samples and put them in the testing machine to get our tensiles and elongations. We ran along on that, keeping each piece and a record of it

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in line. When we got through we noticed we had a curve up and down of tensiles that didn't tie in with anything we could figure on—it was too long. Finally somebody had a bright idea: How does that tie in with the wire at the annealed side before you give it the final drawing? It tied in perfectly. You could figure it back, and your wave for one coil was tucked inside the bundle and the other came out like that. (Indicating). That was the distance of your wave, and it isn't surface finishing, as Mr. Granger says, it is light reflection entirely. In one place your temper will turn up and then down and down and then it will turn up.

We happen to have a strand tube annealing furnace, and you will never get the pattern off of that. That is absolutely uniform. That is, if you anneal your wire before your final drawing through a strand annealing furnace you won't get any pattern in your cloth.

Mr. Granger: I might say also that you will never get this on copper wire. You will get it on bronze wire and on steel wire.

The Chairman: As I said before, I think that we are agreed on this one conclusion—more or less a unanimous opinion—and that is we are in agreement down to a certain point. My only comment is that I am glad I am not weaving wires.

Mr. Lewis: Something just occurred to me. Remember when we had our first meeting ten or 12 years ago and Ralph Cohn was there? Ralph had a paper on something, cost accounting, I believe. Ralph was in charge of a screen cloth plant at that time and his plant turned out a high quality cloth and was reputed to have no trouble, and we started buzzing him about what was his secret. He told us that the only secret was eternal vigilance and careful attention to every detail in the process to secure and maintain uniformity. I thought the son-of-a-gun did have a secret and that he was trying to brush us off, but I have come to the conclusion that he was right.

The Chairman: I think all of us will agree that uniformity today is absolutely necessary in all practises, not only in weaving wire but all others, and we realize that uniformity of temper is also extremely sensitive. I believe we have spent all the time we should on this discussion. There is one comment, however, that I haven't heard brought up on this weaving wire business, and that is that it started in at the time we started to carbidize dies. I am very much surprised that that didn't come up, because at the time everything was started on carbide dies and lots of things happened. And the statement has been made that it was all because of new equipment, but new equipment was used in this case where it should have been carbide dies. I didn't hear that mentioned.

THERE WAS NO DISCUSSION ON THE PAPERS ON "CEMENTED CARBIDE" AND "WELDING ELECTRODES"

Session, Thursday, October 15, 1942 - 9:45 A. M.

Chairman of Meeting

A. E. Glen, Assistant General Mgr. of Sales
Carboloy Company, Inc., Detroit Michigan

PAPER: "Submerged Combustion Takes Its Place in the War Industries"	Walter G. See, Sales & Service Manager	Submerged Combustion Co. of America, Hammond, Indiana
PAPER: "Electric Patenting of Wire"	John P. Zur, Metallurgical Engineer	Trauwood Engineering Company, Cleveland, Ohio

PAPER: "SUBMERGED COMBUSTION TAKES ITS PLACE IN THE WAR INDUSTRIES"

The Chairman: Our first speaker this morning will be Mr. Walter George See, Sales and Service Manager of the Submerged Combustion Company of America. Mr. See will talk on "Pickling of Rod and Wire." Mr. See (Applause).

Mr. Walter George See at this time then read the following paper:

The Chairman: Thank you, Mr. See. Now if any of you gentlemen have any questions I think Mr. See will be glad to try to give you the answer. Are there any questions or comments?

A Member: I was wondering if Mr. See's comparison of the solution agitation between Submerged Combustion and steam included an injector type nozzle or just a coil containing a series of holes from which the steam is emitted.

Mr. See: This comparison is between any open jet steam pipe from which the steam is forced into the solution.

Same Member: Does this include an injector such as made by the Duriron Company?

Mr. See: Yes. Any open steam heating method is covered.

Same Member: An injector such as is manufactured by the Duriron Company gives agitation which is probably more comparable to that obtained by Submerged Combustion than could possibly be obtained by an open steam line—is this not true?

Mr. See: Such an injector is better than a simple open steam pipe but we have always refused to accept the fact that there is a comparable agitation in the bath obtained by the use of steam alone. The reason for this refusal is that as soon as steam leaves its carrying method —pipe or nozzle—and strikes the solution, it immediately condenses into water and, in so doing, contracts greatly and looses its force. The result is a very slow stirring of the pickling solution.

On the other hand, if air or gases are used there is nothing to slow up the force of the air or gases until it has bubbled through the solution and reached the surface of the bath and a terrific agitation is created. In a normal Submerged Combustion bath the agitation gained by the air and gases being emitted into the solution causes it to travel approximately 8 to 10 miles per hour across the surface of the tank. We have present today, several users of Submerged Combustion, and I am quite sure they would back me up on that statement. Several users have commented that the agitation gained by Submerged Combustion makes the surface of the bath look like Niagara Gorge. It is usually necessary to have from 6 to 8 inches from the top of the bath to the top of the tank, to keep the solution from splashing over the edge of the vat. With this in mind it is evident that there is a vast difference between the agitation as we define it and the slow stirring obtained with steam. Does that answer your question?

Same Member: Yes.

A Member: Was that 60 degree acid?

Mr. See: Sixty degree acid was used in most all the cases mentioned in this paper as this is the strength of concentrated acid most generally used.

Same Member: I thought you said something about 20 pounds.

Mr. See: That figure referred to pound of acid consumed per ton of steel pickled and was received from one of our customers whose name I cannot divulge publicly but will be pleased to tell you privately.

Same Member: I wasn't interested in that; I just wanted to check it.

Mr. See: In that case the acid consumption was reduced from 23.1# to 18.4#.

Same Member: What type rod is that on?

Mr. See: On rods made in a cold finished mill. The average size would be approximately $\frac{7}{16}$". Does that answer the question?

Same Member: Yes.

The Chairman: Any other questions? I should think we would be able to have a little more discussion.

A Member: In your calculations do you use an inhibitor?

Mr. See: Yes, sir. When Submerged Combustion is used in pickling, there should be no change in the previous tank make-up. If an inhibitor was used regularly, we would recommend continuing its use. If none was used formerly, there is no reason to start simply because Submerged Combustion is being used. The percentage of acid strength is maintained as always, although the pickling temperature can be lowered in many cases. There is no other change in the pickling practice.

A Member: I would like to ask two questions. First of all, are you talking about Sulphuric Acid only or are you talking about Sulphuric and Hydrochloric Acids?

Secondly, I wish you would say a little more about the heating of lime.

Mr. See: All of the acid figures that were given were on Sulphuric Acid. However, Hydrochloric Acid can also be heated by this method.

To answer your second question. I mentioned immersion burners for heating the lime bath. Now immersion burners and submerged combustion burners differ in this respect. Immersion burners burn the fuel in a pipe or combustion chamber and emit the products of combustion outside of the solution. Submerged Combustion burners force the products of combustion into and through the solution. Submerged Combustion has not been used for heating lime because the products of combustion, mainly CO_2, are slightly acidic and also tend to precipitate the lime. This reaction might not be noticed for several weeks and even then the lime might look the same as it always did but probably would not cling to the steel the way it should and there would be quite a heavy sediment in the bottom of the tank. Immersion heating of lime has been quite successful, however. Atmospheric or motor-mix burners have been used to fire into heating coils of various shapes and designs. I see Dick Weyant from Reynolds Wire Company in Dixon, Illinois. They have developed a set-up for their lime bath which I understand is very successful. Perhaps he could tell you more about it. Have I answered your question?

Same Member: Yes.

The Chairman: Has Mr. Weyant anything further to add to that? (No response). Any other questions? If not, we will go on to the next paper. I just want to thank you again, Mr. See. Did you have something further that you would like to say?

Mr. See: I have nothing further to say except that I have an appointment immediately after this discussion and beg to be excused.

PAPER: "ELECTRIC PATENTING OF WIRE"

The Chairman: Does anybody have a question or two? It would seem to me that after such an interesting paper we should have a very good discussion.

A Member: Mr. Zur, you have been referring all through your talk, to conventional patenting. As I know conventional patenting in the wire industry, several methods are used, and you did bring out some instances of double lead patenting but in most cases you were referring to conventional furnace patenting versus electric patenting. Was that air cooled after that was quenched?

Mr. Zur: That was the typical lead quenching operation.

A Member: Did you experience any difficulty in making contact with drawn wire through having possibly too much coating on the wire?

Mr. Zur: In that connection we have had no difficulty in treating either rods or drawn material. It represents no problem at all even where the wire is heavily limed or coated with a wire drawing compound. There is no difference in contact conditions.

A Member: In some cases where electric welders are trying to coat wire some wires are so heavy they can't make a good electrical contact, and I wondered if you had the same trouble occasionally with that.

Mr. Zur: We have a little different condition here. Contact is made in a molten metal bath and both mechanically and electrically ideal conditions prevail because we have good mechanical pressure over a long surface of wire. The current density is distributed over a large surface area.

A Member: Mr. Zur, you refer to decarburization on furnace patented materials. It has been our experience that there is no decarburization associated with furnace patented material. A study of decarburization will show that it takes quite a period of time to produce decarburization because it will scale much faster than it will decarburize. The type of structure you showed there, as far as decarburization is concerned, is associated with hot rolled rods even prior to the patenting treatment, and I would think it was more of a carryover from the rod than a result of the furnace patenting treatment.

It has been our experience that you can actually reduce the decarburization by scaling in the air patenting or in the single lead patenting operation. Of course, in double lead patenting you don't have any scaling or decarburization effect. In each case though the time and temperature in any patenting operation is so short that I do not think the question of decarburization is an important factor.

Mr. Zur: That is true. However, these microstructures were made in the course of an investigation, comparing the electric patented treatment with the furnace patented and salt quenched material, and in the case of the electrical patented material, where decarburization was looked for, practically none was found despite the fact that the samples were taken from the same batch of steel.

A Member: That could easily result from a number of things. If you went around the edge carefully you might find, even in the same sample, quite a variation in the amount of decarburization. It may be more apparent on one side than on another, but I don't think you would get much decarburization in the relatively short period of time involved in patenting, because decarburization depends on the diffusion of gases out to the surface, and there isn't really much time involved in connection with the patented treatment to permit that. In fact, as I said before, I have seen numerous cases where we reduced decarburization by virtue of scaling in the patented operation.

And another feature: You don't want to lose too much sight of the fact that while the scaling associated with air patenting or furnace heated materials may appear bad on the face of it, it doesn't necessarily follow that it has any great injurious effect. On the other hand, it can well provide an improvement to the surface. It can tend to take out certain surface imperfections which are in the rod, and that has been in these days, in the absence of better stock, utilized to advantage to improve the surface. In other words, scaling has been employed to improve the surface. We can't altogether condemn the use of scaling in connection with patenting. You can readily see what I mean there. You tend to lift some of the surface off and you can improve it.

Mr. Zur: With further reference to decarburization, particularly of its effect on the fatigue life of wires which we have investigated, we have found that in the case of furnace patented material there was a decarburized layer, and in the case of electrical patented and drawn material there was practically no decarburization, and in every case the fatigue life of the electricially patented and drawn wire was considerably higher than that of the furnace patented and drawn material.

A Member: Suppose that in the case of the electrical patented material, you had a decarburized area in the rod after it left the rod room. I don't see what you could do to correct it.

Mr. Zur: Unquestionably, the decarburization on the rod wouldn't be eliminated by subsequent electric patenting treatment.

A Member: I think on a further study of it you would find in each case where you encountered decarburization in the patented material that it is traceable back to the heating operation in connection with the hot rolling.

There was another point I wanted to bring out and that is you referred a number of times to the dispersion of carbides in the absence of a lameller type of structure. What are the temperatures at which this quench occurs? What is your quench temperature?

Mr. Zur: In the case of the electrically patented treatment the temperatures used on carbon steel wire are seldom in excess of 1650, usually in the range from 1600 to 1650, and the quenching media is held in the neighborhood of 950 to 1100, depending on the properties required.

A Member: According to the work we have done, and others, too, with the electronic microscope, the pearlite persists with transformation temperatures as low as 850, from 850 down, and you get some dispersion typical of what we call the spheroidal type. Now at a quenched temperature of 900° F. it would be obvious that you would have to have all pearlite. If you had complete and uniform distribution in austenite by quenching you would get pearlite as a result of transformation down to 900, and if your lead quenched temperature is 900 you are not going to get any transformation temperatures below 900, so that I question very much if the resultant microstructure is one of dispersion of carbides. It may be extremely fine plates of pearlite, or some type of pearlite, but I don't think that you have a particle of precipitation below 900. I think probably there may be some misunderstanding between us because I think you know that as well as I do.

Mr. Zur: We have quenched electrically heated material very close,—oh, perhaps in a range of 25 to 50° F. above its critical range—and we have found in every case complete solution and carbon diffusion. It is possible to quench very close to the upper critical temperature.

A Member: There is one point in that connection. You are dealing with extremely short time intervals there, and as far as heating is concerned I don't know just what they are, but you take in the case of 1.05" wire—what would be the heating time?

Mr. Zur: It would be a matter of about 10 to 11 seconds approximately.

A Member: I am just wondering if you were to take the two extreme types of structures—to start with, for example, a normalized material or a previously patented material in one case, and in the other case a completely spheroidized material, and subject them both to the same ten second exposure temperature or heating time. I was wondering if you wouldn't bring out some differences there. In other words, the rate of solution in the soft material would be much slower than it would be in the prior patented material, and I think that perhaps some work along that line might give you some measuring stick as to the rate of solution. Maybe you have already done that, but the point that I want to bring out is that in some of the steels such as 50 carbon steel in rod form, or that drawn into wire, there is a large amount of free ferrite, which has to be dissolved or you don't have a uniform austenite. I would think with such short time intervals that the structure of the material prior to patenting, would play quite an important part, because we can't obtain this solution fast, and perfect with distribution in the austenite, all at once. It is going to take some time. I realize the possibilities of the influence in electrical heating of the faster rate of solution but I think that even then there is a time that must elapse to complete this solution and to make the distribution in the austenite uniform. So I think that the question of what the material is and what the micro-structure was prior to patenting might have an influence on it.

Mr. Zur: We have found that to be the case. However, we have very satisfactorily annealed the higher alloy steels —for instance, stainless steel—in which case the carbides are usually very difficult to get into solution. Ordinary furnace practises require considerable time at temperature, and we have treated such materials with a typical short resistance heating cycle where the temperature progresses uniformly and there is no soaking at the maximum temperature. We had no difficulty in getting such materials into solution at quite high speeds.

A Member: There is another point I would like to mention—then I will close. We attached considerable importance to the fact that the material was quenched from a rising temperature. I think that question has been passed back and forth

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in the wire industry for a good many years. Some people say it should be quenched from a rising temperature and other people say it should not.

I don't think enough importance has been attached to the question of complete diffusion of the carbide in the austenite. I don't think that any of us have given enough consideration to that. As soon as you start quenching from a rising temperature you have the possibility of quenching from either an incomplete solution or a non-uniform austenite, that is always associated with it. On the other hand, quenching from a temperature that is slightly lower but still not low enough to produce any precipitation prior to the quench, you will still have some assurance that you will have uniform austenite.

I don't want anybody to think that I question the value of this process. These are just my points, you might say, in my consideration of it.

We can't question your results because we have no data to do so with, but we talk about the question of fine grain and coarse grain material in connection with cold drawing. Well, up to the present metallurgists recognize the fact that the greater plasticity is associated with coarse grain materials, by reason of the less interference of slip because of the minimum amount of grain boundary material. So when we come to the finer grain size material, such as developed in electric patenting, we naturally under ordinary conditions—maybe we don't understand it too well—but, naturally, we expect that we are going to get greater interference to plastic flow by virtue of a greater amount of grain boundary material and greater interference to slip. That is more or less the recognized thought along that line. As I say, maybe we don't understand that very well or maybe it doesn't really apply in this case, but that is a point, that the higher ductility in cold working is usually associated with the coarse grain material.

Another point you raised there was that the size of the final grain was the function of the grain prior to precipitation from the austenite. There is a relationship between the two, but you take in the case of extremely low carbon material, where you have nothing but ferrite grains, when you go above 1650° or 1700° you have extremely coarse austenite. Yet on cooling you produce what I call an alpha grain size, which is much smaller than the austenitic grain size. Our work indicated that whether you have low carbon steel with free ferrite or whether you have eutectoid steel with 100% pearlite, there is an alpha grain size that is a lot smaller than the original austenitic grain size. However, we do recognize an inheritance, and you are getting the benefit of the fact that if you keep the austenitic grain size small you subsequently get a smaller grain size. I think that is true. The rate of quench is an important fact, and austenitic grain size is important in determining the size of the finished grain size.

Mr. Zur: All of these points which were mentioned in our paper here are based on the results obtained over a long period of time in various steel mills which are using this particular type of patenting treatment for high carbon steel wire. Of course, there are numerous theories which could be offered to explain some of the phenomena which take place when carbon steel is cold worked, but we are basing our conclusions on results and are not trying to explain the mechanics involved.

A Member: I recognize that I am not questioning the results. I have no intention of questioning any of the figures you offered there at all because I haven't any data to question them with. I am not trying to criticise the general run of the paper at all. Those are the points I wanted to bring out. There is a good possibility that we may learn an awful lot from the results of this work, and, of course, there are some of us who always like to find out not just the fact that it will do something but why does it do that, and the true answer will never come out until we do know why. That, of course, is the thing I am seeking.

The Chairman: Any other questions? Everybody seems to be quite interested here. I think we should still have a little time left if anybody has anything further to add.

A Member: Mr. Zur, on that comparison between air patented stock and electrically patented stock, 67 carbon on the physical properties, I believe the air patented stock had 146,000 tensile and only 29% reduction in area, that material must be extremely low in hardenability. That is about as low as I have ever seen in air patented stock. We usually go to at least 57%.

Mr. Zur: This was a wire produced by furnace heating and salt quenching, and

(*Please turn to Page 89*)

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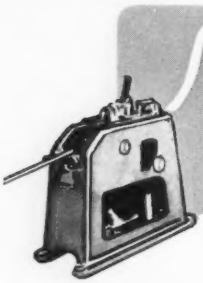

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Government Wire Production Information

Sales of Copper and Steel From Inventories to Be Reported

OWNERS of idle stocks of copper and steel, and their alloys, who sell directly to authorized war producers, as permitted by Priorities Regulation No. 13, are now required to report such sales by an amendment to that regulation.

✦ ✦ ✦

WHEN a sale is made of copper from inventories previously reported to the War Production Board, care Copper Recovery Corporation, 200 Madison Avenue, New York, New York, the seller must now send a copy of the invoice to that address.

✦ ✦ ✦

SELLERS of steel from reported inventories should address their invoice copies to WPB, care Steel Recovery Corporation, 5835 Baum Boulevard, Pittsburgh, Pa.

✦ ✦ ✦

Stainless Steel Released for Military Use

USE of stainless steel in several products needed by the armed forces is permitted by Order M-126, as amended Nov. 30, 1942.

✦ ✦ ✦

PRIOR to this action, use of stainless steel had been prohibited for these products after January 5, 1943. The amended order, transferring the items in question to a military exemption list, gives steel mills and fabricators advance notice of the change and prevents any possible tie-up of important military products.

✦ ✦ ✦

THE items placed on the exemption list are: ammunition boxes and chutes; boiler casings; cable terminals, fittings and turnbuckles; chains and cables; control levers; hot water heaters, tanks and coils; military identification tags and badges; radio antennas; powder boxes; stock pots, and canteens.

✦ ✦ ✦

THE order also exempts Army-Navy - Maritime orders for stainless steel which have been approved by the Director General

on form PD-391 for melting and delivery during the fourth quarter.

✦ ✦ ✦

Gilding Metal Clad Steel Scrap

GILDING metal clad steel scrap —a by-product of munitions manufacture—has been exempted from price control by the Office of Price Administration.

✦ ✦ ✦

THIS article is steel coated with an alloy of approximately 90 per cent copper and 10 per cent zinc, and is being substituted for copper in shell and cartride cases. The volume of gilding metal clad steel scrap at shell case plants is growing but the material in its unprocessed form is not now used commercially. Processes for separating the steel and copper in the scrap economically so that they may be re-used as straight steel scrap and refined copper are now being developed. Only one process, however, has advanced beyond the experimental stage, and that process has not yet been put into industrial use.

✦ ✦ ✦

IN view of the newness of the process, there is not enough cost data available to determine a fair price for such scrap. The exemption, OPA said, will have no inflationary effect, for steel scrap and refined copper—chief products from processed gilding metal clad steel scrap—are under price control.

✦ ✦ ✦

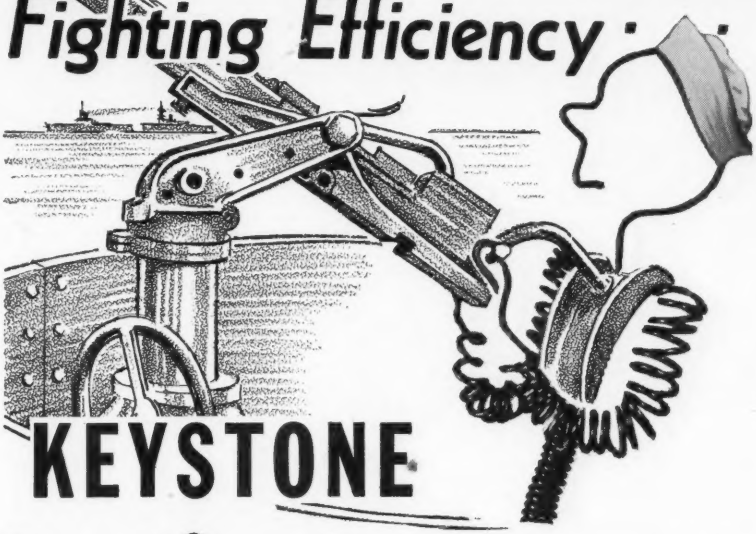
AMENDMENT No. 43 to Supplementary Regulation No. 1 to the General Maximum Price Regulation contains the exemption. It became effective as of November 16, 1942. ✦ ✦ ✦

Further Restrictions on Zinc

AMERICA'S critical shortage of zinc has led to further curtailment of less essential uses in order to make more of the metal available for ammunition and other war products. Conservation Order M-11-b, as amended, issued Nov. 26, 1942, further restricts use of zinc for manufacture of a variety of automobile parts, building materials, and industrial materials, and clarifies the language of the order to make it clear that protective coating and galvanizing is

(*Please turn to Page 64*)

Part of the Fleet's Fighting Efficiency . . .



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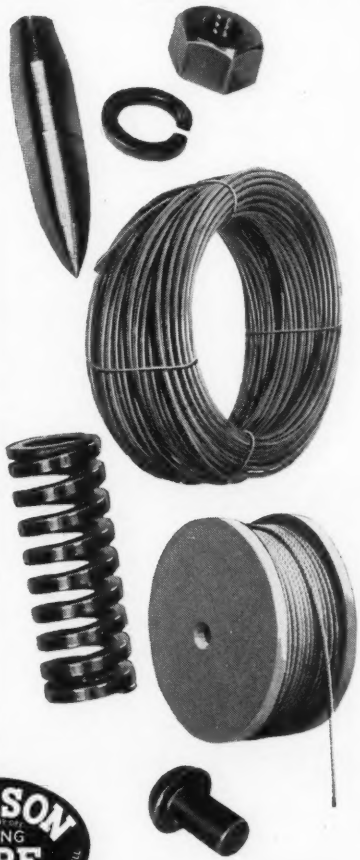

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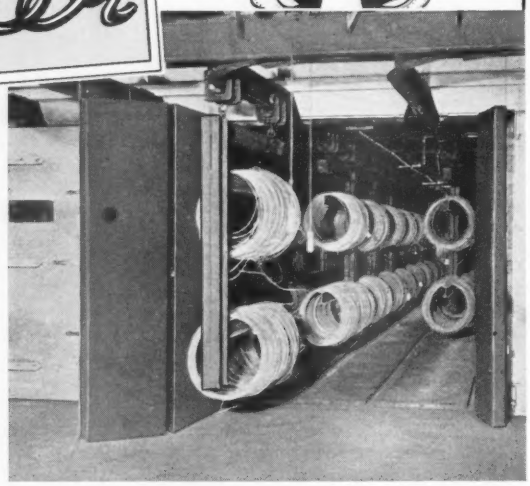

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Government Wire Production Information

(*Continued from Page 65*)

included in the restrictions of the order.

✦ ✦ ✦

HEALTH supplies, various precision instruments, and dies—all having been found necessary to war industry—are placed in the non-restricted class by this amendment, and may be made with zinc. Prohibition on use of zinc in stoker repair and maintenance parts is eased to permit use of 50 per cent of the amount used in 1941 instead of being forbidden entirely. Likewise, restriction on use of zinc in functional and mechanical items for gasoline and diesel engines is similarily eased.

✦ ✦ ✦

THE new restriction on plating and protective coating (which includes galvanizing) says that no items on list "A" or "A-1" of the order may be made of metal coated with zinc, and that none of the scores of items on the lists may be coated with zinc. Paint is excepted. For all items not included on the lists, made for civilian purposes, not more zinc may be used than 75 per cent of prime western or 50 per cent of any other grade of the zinc used by any person in the corresponding calendar quarter of 1941.

✦ ✦ ✦

THIS tighter conservation of zinc is required because the supply is not great enough to meet essential needs. The metal is used in large quantities in cartridge brass, ship propellers, guns and tanks, and in a wide variety of essential military items. Shortage of the metal is partially attributable to labor shortage in the Western mines, and partly to the development of military demands enormously greater than our accustomed production and consumption of zinc.

✦ ✦ ✦

Proposed Wire Rope Practice Before Industry

A PROPOSED simplified practice recommendation for wire rope designed to conserve strategic materials and available productive capacity for the war program and

at the same time to adequately care for important consumer requirements is now before producers, distributors, users and others interested for approval or comment, according to the Division of Simplified Practice, National Bureau of Standards, Washington.

✦ ✦ ✦

GENERAL adherence to the twenty tables shown in this recommendation will result in a net reduction in variety, from 973 items to 648.

✦ ✦ ✦

THE major production and use of wire rope, and therefore the predominant tonnage is covered by four different rope-constructions where the reduction in variety is from 352 items to 182.

✦ ✦ ✦

THE proposed recommendation was developed by the contact committee of the Wire Rope and Strand Manufacturers Association, and submitted for passage through the regular procedure of the Division of Simplified Practice, at the request of the Wire and Wire Products Section, Iron and Steel Branch of the War Production Board.

✦ ✦ ✦

All Tungsten Supplies Put Under Full Allocation

ALL supplies of tungsten wire, rod, sheet and powder were placed under complete allocation control by an amended version of Order M-29. Formerly, unrestricted deliveries of up to 25 pounds of contained tungsten monthly were permitted by the order. To further conserve the supply of the metal, this permission has been made inapplicable to the tungsten products mentioned above.

✦ ✦ ✦

TUNGSTEN is used principally in high-speed tool steels. Control over the supply was first established in March, 1941.

✦ ✦ ✦

Molybdenum, Tungsten Wire, Rod Advisory Groups Formed

FORMATION of a Molybdenum and Tungsten Wire and Rod Industry Advisory Committee has been announced by WPB Division of Industry Advisory Committees. Government presiding officer is **M. T. Metzger,** assistant chief, Ferro Alloys Branch.

For Information Regarding The Wire Association Address

Richard E. Brown, Secretary
300 Main St. Stamford, Conn.

✦ ✦ ✦

COMMITTEE members are: Frank Bishop, General Electric Co., Cleveland; H. W. Boessenkool, North American Phillips Co., Lewiston, Me.; R. S. Broadbent, Westinghouse Electric & Mfg. Co., Bloomfield, N. J.; A. J. Dowe, Fansteel Metallurgical Corp., Chicago; William N. Mansfield, Cleveland Tungsten Corp., Cleveland; D. Ruotolo, Sirian Wire & Contact Co., Newark, N. J.; and G. C. Wheeler, Callite Corp., Union City, N. J.

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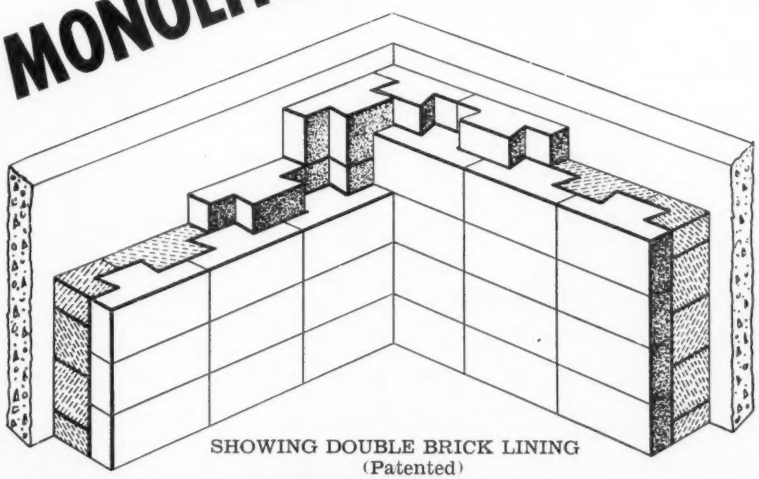

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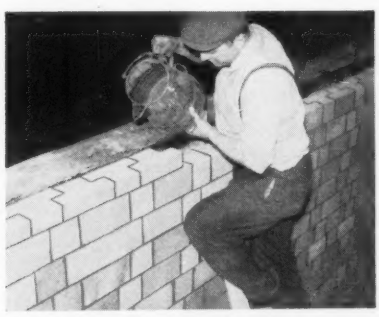

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Some Interesting War Viewpoints From Correspondents

THE following letters from members of the Wire Association, one from England and one from Australia, show the changed conditions which war has brought about not only in ordinary living but in business in these countries. The courage of the people as evidenced by the expressed opinions in the letters is beyond question.

✦ ✦ ✦

THE letters should serve to bring to mind that while we are at war the people of our country do not seem to realize that we are "in" war as yet.

✦ ✦ ✦

THE thoughts expressed by the writers should be considered carefully by every American as they are definitely an indication of what we too are facing here.

✦ ✦ ✦

From England

It is a long time since I wrote to you about anything but small matters of business, and I gather from your letter of May 14th which certainly gave me a good deal of information, that you would like a similar letter back.

Well, I cannot say much about the progress of munition factories, except that in my opinion we are getting near the peak of our effort, and I say this from the labour angle. All our women are working, but I don't think you can realize what this means; in England, as you know, anybody with over a few hundreds a year used to keep at least one maid, and well-to-do folk used to keep a bunch of them; that is all finished now—there aren't any maids, as they are all working at something else. Every man's wife no matter what rank, if she is under 40 years of age, is working unless she has some small children. All women are working whether they like it or not, and many of them are nowhere near their homes; they have left their houses and their husbands and are working on whatever job requires doing in their neighborhood. Of course they are making good wages, but that is quite beside the point. The great thing is that there are very few people available to be put into jobs; and we are getting very near the limit.

To keep my own household running, and it is a big house, I have a little girl of 14 years of age; my cook is a land girl working all day on the land and comes in to cook my dinner at night; my parlour-maid is also working all-day long and comes in to serve the dinner at night and makes one or two beds in the morning before she goes off to her work. Of course they are doing well and they don't mind, and we are more or less all friendly together, but you see the position is that there is no idleness in this country.

Now we cannot very well take a holiday—people like myself at any rate; we try to of course, but the last time I tried I found 6 old men to play Golf with, all of them over 70, and I felt quite a boy amongst them—and I am 65. There is no petrol for pleasure motoring, therefore you must go by train, and you won't go by train if you can avoid it; you might get a seat, and then again you might not, but whether you get a seat or not the train would be packed to capacity and there is nothing to eat on it. It is very uncomfortable so you just don't go!

We have daylight-saving, and as you know we save 2 hours a day which makes the evenings very nice indeed; it is daylight until nearly 11 o'clock at present, but when I tell you that in the last twelve months, Summer and Winter, I have not been out to any party or any jollification, and that during the darker months I have never been out of my house after 6 o'clock in the evening just because of the discomfort and because I have no petrol, you can perhaps realize what we are doing in this country. Of course some of the younger folk go out at night and risk being smashed up on the dark roads, but I won't take the chance.

We are looking forward to being rationed for fuel this coming Winter, and here of course there is room for criticism; my smallest rooms are about 26 ft. x 20 ft. and my house is centrally heated. Well, it won't be heated next Winter and I am told to get ready for having about 2 fires only in the house, and believe me it will be just like an ice house. So I'm looking out for some flannel shirts, some old ones I have not worn for years, and I'm going to wear

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these over two sets of underclothes; I shall survive, but I shall grumble, and I suppose I shall be cold, but we shall get used to it just as we have got used to many other things.

Now the food situation is not so bad; we have plenty of good solid wholesome food, but we have no trimmings of any moment. Of course we have not had any fruit since last Summer; I think there have been a few oranges round about, but speaking broadly we have no fruit until the trees crop this Summer.

However, we are all very cheerful, and though we are not winning the war in the sense that we are winning battles, this country has no doubt about the ultimate outcome, and we are quite sure that we are no bigger fools than any other nation; the mistakes we are making will in due course be rectified, and we do not believe they are any more serious than other people's mistakes. I personally am sure that in the long run we shall make fewer "bloomers" than our enemies.

This country is full of troops and munitions, and we could resist an invasion I think quite comfortably—but I don't believe we shall ever have one; we are going to do the invading ourselves, but I'm also certain that those people who are crying so loudly for a second front won't cry so much when they see the casualties, as they are bound to be very serious and heavy.

Our relations with labour are pretty good, and with the exception of some small troubles in the coal trade, most workmen are doing their best; I think we can still do better, but not a lot, and for any improvement in the materials position we shall have to look to the United States, as we are doing, and I am quite certain they will fill the bill, and that some fine day (I don't know how many years hence) the thing will end. It is my private opinion that the trouble will begin when the war finishes; I don't know how far I am right in this but it is what I thoroughly believe; the Armistice period, which might extend for years, will be a very, very troublesome time, and industry in this country will be in leading strings for longer than I shall be working. I think that is fairly well indicated. It does not depress me because men like myself have made up their minds that they will not see again prosperity as we used to know it. Our prosperity will have to be that of the mind, and being satisfied with values that are not material, as it is very obvious that never again will large houses in England be occupied by wealthy people; they will have to be closed down or turned into Museums, or just left to rot away like Manor houses and Castles were in former times, the ruins of which we see up and down the country.

The incidence of taxation which makes it impossible for any man to have more than say £5,000 a year is really a levy on Capital and as a matter of fact his capital is gone. I do the sum this way: I know that in 1914 before the last war a man with £100,000 in England was quite well-to-do; he could buy almost anything he wanted from his income of about £5,000 a year, but his purchasing power had fallen to about £2,500. Therefore in effect his wealth had gone down by one-half. The same process is going on now and it is very obvious that at the end of this war the £100,000 man will not be able to buy £5,000 worth of goods as he did in 1914, but only £1,250 if as much, and therefore a fortune of such monies is no fortune at all.

I don't know what the Newspapers and public men are preaching in the States, but here, when they are not talking about the war, they are preaching about a brave new World we are going to build when it is over. Candidly I don't believe in a brave new World—I don't think it will happen—I think it will be the same old World with the same stupid men in it as there is today, and collectively we shall be a lot poorer as we must be, seeing that for so many years we are destroying our wealth.

But with all this, this country is not pessimistic. We don't mind; in another generation we shall pick it all up, possibly, but not by means of any great schemes; if ever we do pick it up, we shall do as they did in the past, by private and individual enterprise which, if given a free hand, will get us out of our troubles.

With kindest regards.

From Australia

Possibly you have been wondering what's happened "down under" and why you haven't been receiving more mail from me.

(*Please turn to Page 74*)

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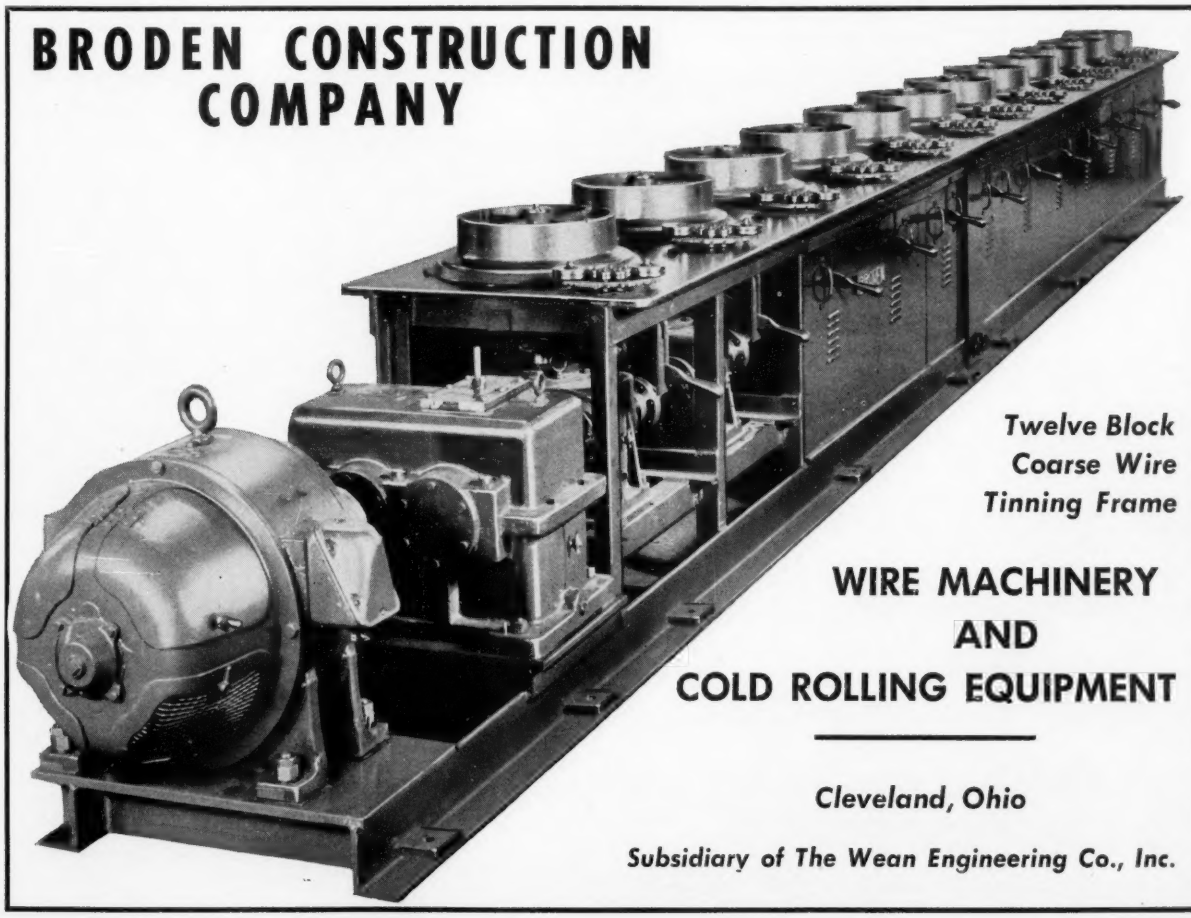

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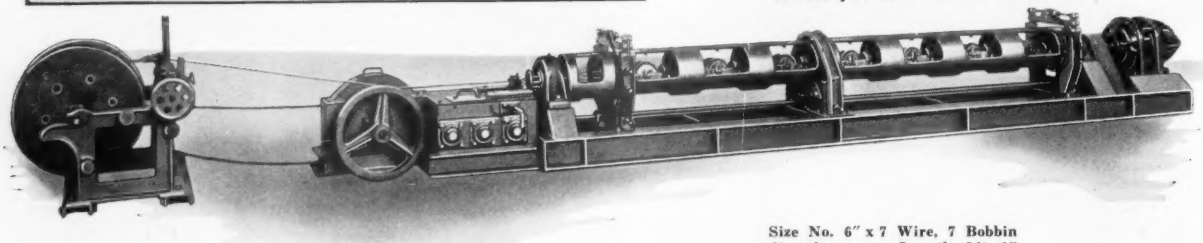

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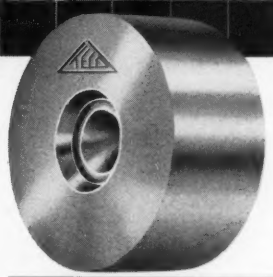

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SHORT, CHARLES P., Spec. Repr.,
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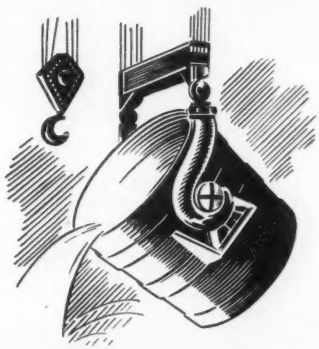
Hamilton, Ont., Canada.
SICKELS, EDMUND D., Adv. Mgr.,
"WIRE & WIRE PRODUCTS"
Stamford, Conn.
SIMMONS, RAY, Chief Metallurgist,
Keystone Steel & Wire Co.,
Peoria, Illinois.
SLAGLE, GEORGE H., Supt., Fabrication Div.,
Beryllium Corp. of Penna.,
Temple, Penna.
SLOMAN, C. M.,
U. S. Rubber Company,
Detroit, Michigan.
SMITH, DR. CHAS. COPELAND, Nat. Lecturer,
National Assn. of Manufacturers,
New York, N. Y.
SMITH, LT. COL. PHIL, On the Staff,
War Department,
Washington, D. C.
SNOWDEN, H. N., Works Manager,
Seneca Wire & Mfg. Company,
Fostoria, Ohio.
SOMERVILLE, W. E., President,
W. E. Somerville & Co.,
Coal City, Illinois.
SOMMER, LESTER B., Asst. to Pres.,
Mid-States Steel & Wire Co.,
Crawfordsville, Indiana.
SOMMER, W. H., President,
Keystone Steel & Wire Co.,
Peoria, Illinois.
SPENGEL, R. S., Secy-Treas.,
"WIRE & WIRE PRODUCTS"
Stamford, Conn.
SPRUANCE, F. P., Vice-Pres.,
American Chemical Paint Co.,
Ambler, Penna.
STEVENS, D. R., Vice-Pres.,
Okonite Company,
Passaic, New Jersey.

(*Please turn to Page 72*)

ACP Products and Processes CONTRIBUTE in Record Steel Production



With steel mills throughout the land straining for peak production, the savings in steel and acid made possible by RODINE are more important than ever before. Also of great importance now is the safety factor provided by RODINE. It prevents over-pickling and scrapping of finished steel under the pressure of the rush to produce.

Other ACP Products and processes are lending a hand, too. CUPRODINE is used to produce a dense, bright copper coating on steel by a simple immersion (non-electrolytic) process in wire mills and on steel shell cases before drawing. RIDOLINE and the ACP Alkali Cleaning System cleans strip and plates in a continuous operation to speed-up production and provide better finishes.

•

These Products and Processes are, however, only typical of the many contributions ACP can make to your production goal.

Others include: DEOXIDINE to prepare steel, aluminum and dural properly for painting; FLOSOL the exceptional soldering flux; KEMICK for painting metals subject to high temperatures; LITHOFORM to coat galvanized iron to hold paint.

Let the quarter-century of experience that has made ACP Products and Processes known the world over help you solve the problems of today's production . . . no matter what your metal treating and finishing needs.

AMERICAN CHEMICAL PAINT CO.

MAIN OFFICE AND WORKS
AMBLER . . . PENNA.

ACP

CHEMICALS ACP PROCESSES

DETROIT, MICH., 6335 Palmer Ave., E.
CANADIAN BRANCH
WALKERVILLE . . . ONT.

ATTENDANCE LIST
Cleveland Convention
(Continued from Page 73)

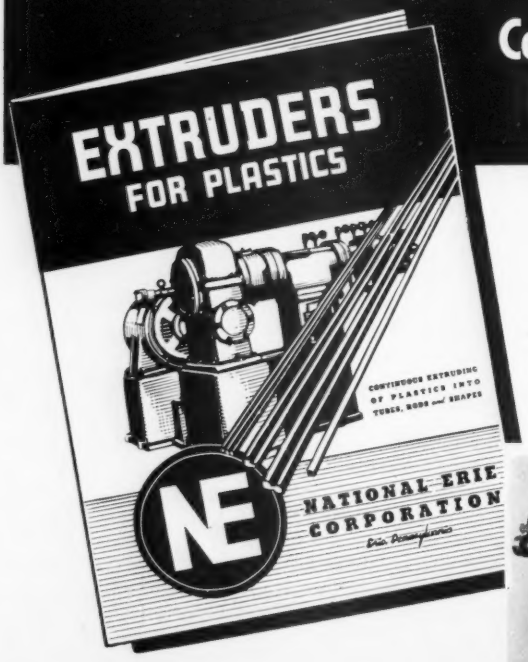
STOUT, E. C., Sales Mgr., Wire Dept., Wickwire Spencer Steel Co., New York, N. Y.
TATNALL, R. R., Metallurgical Engr., Wickwire Spencer Steel Co., Worcester, Mass.
TAYLOR, GEORGE F., Res. Physicist & Metal., Carboloy Company, Inc., Detroit, Michigan.
THOMAS, EARLE H., Supt., Geo. W. Prentiss & Co., Holyoke, Mass.
TIDD, HOWARD S., Asst. Supt., Crucible Steel Co. of America, Syracuse, New York.
TILYOU, IVON B., Asst. Utility Co-ordinator, Industrial Salvage Section, War Production Board, Washington, D. C.
TIMBERLAKE, J. E., Wire Dept., Jones & Laughlin Steel Corp., Pittsburgh, Penna.
TIMBERS, H. H., Contract License Mgr., Western Electric Company, New York, N. Y.
TIMMERMAN, E. D., Supt. Wire Mill, The Steel Co. of Canada, Ltd., Montreal, Canada.
TRAUTMAN, O. C., Vice-Pres., The Trauwood Engineering Co., Cleveland, Ohio.
TIRRELL, W. B., Dist. Manager, Keystone Steel & Wire Co., Chicago, Illinois.
ULLRICH, HENRY F., Asst. Supt., John A. Roebling's Sons Co., Trenton, New Jersey.
UPDIKE, F. TITNA, Dev. Engr., John A. Roebling's Sons Co., Trenton, New Jersey.
VAN HOOK, CHAS. F., Manager, Cable & Wire Machinery Div., Watson Machine Company, Paterson, New Jersey.
VAN VALKENBERG, F. S., Engineer, Waterbury Farrel Fdry. & Mach. Co., Waterbury, Conn.
VAUGHN, L. A., President, The Vaughn Machinery Co., Cuyahoga Falls, Ohio.
VOIGTLANDER, CURTIS, Supt. Wire Mill, Union Wire Rope Corp., Kansas City, Missouri.
VONEMAN, C. J., Asst. Mgr. Indus. Sales, The Dobeckmun Company, Cleveland, Ohio.
WALLACE, WM. M., Service Engr., G. Whitfield Richards, Philadelphia, Penna.
WATT, CLAUDE M., Manufacturing Supt., Canadian General Electric Co., Ltd., Toronto, Canada.
WEIKEL, G. A., Repr., American Chemical Paint Co., Ambler, Penna.
WELSH, J. ALAN, Firthaloy Engr., Firth Sterling Steel Co., McKeesport, Penna.
WENTZ, CHARLES R., Spec. Asst. to Wks. Mgr., John A. Roebling's Sons Co., Trenton, New Jersey.
WEYANT, R. K., Wire Mill Supt., Reynolds Wire Co., Dixon, Illinois.
WHITBECK, ROLAND A., Secy-Treas., Gilron Products Company, Cleveland, Ohio.
WICKWIRE, CHESTER F., Treasurer, Wickwire Brothers, Inc., Cortland, New York.
WIELL-QUILLARDET, L., Consultant, Jersey Steel & Wire Company, New York, N. Y.
WILLIAMS, JACK, Representative, Syncro Machine Company, Chicago, Illinois.
WINKLER, L. H., Metallurgical Engr., Bethlehem Steel Company, Bethlehem, Penna.
WOODHEAD, R. R., Sales Mgr., John A. Manning Paper Co., Troy, New York.
ZAPP, A. R., Mgr., Firthaloy Div., Firth Sterling Steel Co., McKeesport, Penna.
ZUR, JOHN P., Metallurgical Engr., The Trauwood Engineering Co., Cleveland, Ohio.

Some Interesting War Viewpoints From Correspondents
(Continued from Page 69)

Our Organization is on 100% War Work and by the time the end of the day happens along, we haven't the same amount of energy left as we did in Peace times. Further, as Australia is one of the centres of War, you can imagine that the mental strain on everybody in Australia and the mental outlook, is so different from what it was in Peace time.

There are several representatives of American Press Associations and also representatives of the different American Broadcasting Systems down here that you possibly receive much more news of Australia and about what's going on down here, than I can hope to tell you in a letter.

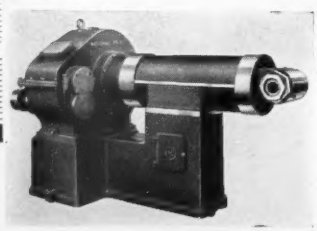
We are all very thankful and so terribly pleased with the number of Americans, Army, Navy and Airmen, down here in Australia and not forgetting a lot of American girls of the different American War Organizations and I don't care where you go in any part of the World, you couldn't find better-mannered and/or better type folks than these Americans I refer to. They all get along so well with all the Australian people and the members of the Australian Fighting Forces. No longer is it a curiosity in any part of Australia for people to stop and say "Oh, there's an American Soldier!" I have been expecting a call on the telephone from some of these Americans saying "I've



Continuous Extruding of Plastics for Wire Insulation and Trim

SEND for a copy of this bulletin that will tell you about a new line of Extruders that has been developed from our well known rubber extruding work. Every machine we build today must contribute directly to the winning of the war—however, you will want to have this bulletin on file whether your need is urgent or not. Write for a copy.

National Erie builds a complete line of Extruders, Presses, Mixing Mills, Special Doors for Pressure Vessels, etc., for rubber and plastics.



NATIONAL-ERIE CORPORATION
ERIE, PA. U. S. A.

got a note of introduction to you", that you'd given them, but so far, nothin's happened!

PLEASE DON'T BE SHY. If any of these Americans down here and/or any of those Americans coming down here are good friends of yours, I'd like to meet them—I'd like to do all I can for them here.

There are many Organizations here who set themselves out to entertain in every way they possibly can, and do all they possibly can for the American Forces—in fact, any and all the Allied Forces who are here in Australia. I'd like to meet somebody who'd seen you recently and then I'd sit down and quaff a few beers, chew the fat, and hear how you are, you so-and-so!

Some time ago you no doubt read in your newspapers that Japanese Submarines just off the Heads of Sydney let a few shells fly, but they did no real damage, and I really mean that. Nobody was killed or hurt. I believe the whole total damage done didn't amount to much. One of these shells landed within 100 yards of my home, and several of them landed within a quarter of a mile, and that was that.

You no doubt read in your newspapers that those submarines that did get into Sydney Harbour, were destroyed. We have since salvaged these Japanese submarines and they're on exhibition here in Sydney and for the equivalent of 20c U. S. Currency, you can go and take a good look at them.

The most interesting thing about the episode was, the Monday morning after the Japanese shelling (The Jap Submarines shelled Sydney on a Sunday night), there was of course quite a lot of talk and cross talk about where the shells landed—(did they get near your place, what and who got hurt, and what have you)—but by night time it was old stuff — nobody panicked — it was a thrill, as it were, for the time, but the Australians went steadily on with their jobs. I think it possibly brought the War much closer to some of them, because we had for a while a few people who thought "IT CAN'T HAPPEN HERE". Just the same, no doubt, as you have a lot of people in U.S.A. who think the same thing. The fact that you're in the middle of U.S.A. does not, in my opinion, make you immune from acts of War caused by these Axis Powers, any the less than if you were in the centre of Australia.

We all down here are expecting to "get it", and preparing for it when it comes, and you can bet your last shirt button that we all down here in Australia will give those Jap so-and-so's, etc., a hell of a fight.

There really isn't any happening that I can talk about apart from War, because Australia is so War-minded and everybody is working and doing everything they possibly can for the successful finish of this War in the earliest possible time. We read about certain rationing of certain articles in your neck of the woods. Similar goods and/or articles are rationed down here in this neck of the woods, but it's really amazing what one can do without that previously in pre-War times one just thought one just HAD to have.

You no doubt have read in your papers many times the fact that General MacArthur is down here doing such an excellent job. You may at times have wondered how an American General was received down here in Australia and put in charge of operations. Let me tell you that everyone was just thrilled to bits to hear it and everyone is behind General MacArthur 100%.

You no doubt have also read in your papers that the Prime Minister of Australia has stated that the General is to have his way always — without interference politically, or of any other kind. We Australians have so much confidence in him that I really believe we forget the fact that he is an American General.

This may seem a strange statement to you, but if I were up in your country, I'd be a foreigner, notwithstanding the fact that we are Allies in this War. If you were down here in this country, you'd be a foreigner. Then, doesn't it strike you as absolutely remarkable we should have a foreigner in charge of the whole of the War operations down here and that we all should be with him, and for him, and behind him, 100%?

I mention this to you just to show you the complete confidence that this country has in your country and in your countrymen, and I sincerely hope and trust that you and yours have the same confidence in us all down here.

I do sincerely hope and trust that nothing and no one up in your neck of the woods will get the idea that this is only a Side-show down here in Australia and that the big Shooting Match is in Europe. They've got a job to do in Europe—they've got a job to do in Libya—they've got a job to do in the

(*Please turn to Page 88*)

DRAW • STRAND • TAKE-UP • TEST • SHIP

Steel Wire for War

ON HUBBARD SPOOLS & REELS

Here are the spools and reels you need, to meet your war time steel wire production requirements.

For over 29 years, Hubbard engineers have been aggressively designing and perfecting better spools and reels for the steel and copper wire industries. Electro-welded-steel construction and patented die-formed head tires are just two of the many Hubbard construction features that assure essential strength, minimum weight, balance, and long life.

Today, when you want the best in a hurry, as well as engineering assistance you can depend on, let Hubbard equipment and Hubbard experience lend you a hand. Give us the facts on the job you must do and we'll send you complete details on the spools and reels that apply.

HUBBARD SPOOL COMPANY

1624 CARROLL AVENUE | CHICAGO, ILLINOIS

Since 1912, manufacturers of wire drawing and annealing, and shipping spools and reels.

A Review of Recent Wire Patents

No. 2,300,400, HEAT CORROSION RESISTANT METALLIC MATERIAL, patented November 3, 1942 by Rae A. Axline, Forest Hills, N. Y., assignor to Metallizing Engineering Company, Inc., Long Island City, N. Y., a corporation of New Jersey.

A coating for iron is provided, comprising a chromium nickel alloy next to the iron, and an outer film of metallic aluminum.

✦ ✦ ✦

No. 2,300,666, ELECTRIC POWER CABLE, patented November 3, 1942 by Francis H. Gooding, Lodi, N. J., assignor to The Okonite-Callender Cable Company, Incorporated, Paterson, N. J., a corporation of New Jersey.

The introduction of a heavy insulating compound into a portion of a length of lead sheathed, oil impregnated, electric power cable where the cable is to be opened for joining purposes and prior to opening the cable, is provided, this compound being of such a nature as eventually to be absorved by the impregnating oil of the cable as the cable is operated and of such viscosity as to prevent escape of any substantial amount of the impregnating oil when the cable is opened.

✦ ✦ ✦

No. 2,300,718, METHOD OF MAKING REINFORCED PADDING SUPPORTS,

Complete Descriptions and Drawings of Patents May Be Had for 25 cents. Address, Wire & Wire Products, 300 Main St., Stamford, Conn.

patented November 3, 1942 by Frank B. Williams and Harold E. Williams, Carthage, Mo.

This method consists in providing two pliable clamps, transversely of the weft wires, and separate from the weft and warp strands.

✦ ✦ ✦

No. 2,301,209, ACCELERATION OF PHOSPHATE COATING WITH QUINONE, patented November 10, 1942 by Robert C. Gibson, Detroit, Mich., assignor to Parker Rust-Proof Company, Detroit, Mich.

For coating iron surfaces, the surfaces are subjected to the action of a solution of an acid phosphate of a coating metal capable of resisting the oxidizing action of quinone and accelerating the coating action of the solution by including in the solution a compatible solution quinone.

✦ ✦ ✦

No. 2,302,057, APPARATUS FOR MAKING SPRING PACKING, patented November 17, 1942 by Charles T. Ripley and Walter M. Gibbs, Chicago, Ill., assignors to Spring Packing Corporation, Chicago, Ill., a corporation of Illinois.

A die is provided for forming, from spring wire, terminally eyed coiled springs.

✦ ✦ ✦

No. 2,302,510, MATERIAL AND METHOD FOR CLEANING AND COATING METAL, patented November 17, 1942 by Robert R. Tanner, Detroit, and Herman J. Lodeesen, Berkley, Mich., assignors to Parker Rust-Proof Company, Detroit, Mich.

Iron, steel or zinc surfaces are coated by applying a film of an acid phosphate coating solution containing an accelerating soluble salt of a metal below the metal to be coated, in the electromotive series, and leaving the film on the surface until a chemically bonded coating is formed on the surface from ingredients of the surface and the solution.

✦ ✦ ✦

No. 2,302,514, BEDSPRING AND THE LIKE, patented November 17, 1942 by Jerome T. Atkinson, Northfield, Ill.

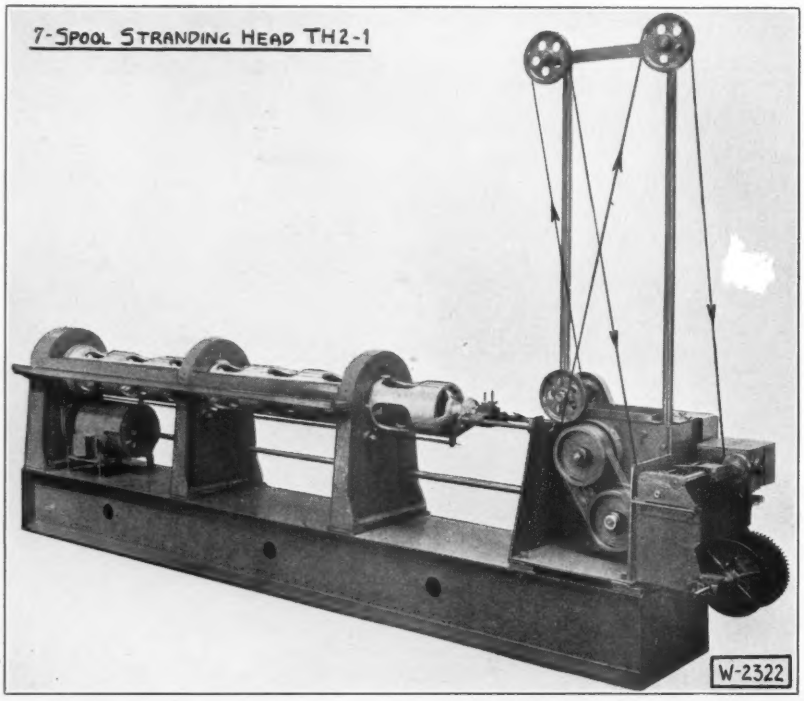
Set screw movable longitudinal strips are provided, associated with wire coil springs, so as to vary the tension of the latter.

✦ ✦ ✦

No. 2,302,675, SELF-TAPPING SCREW, patented November 24, 1942 by Andrew J. Cherry, Chicago, Ill., assignor to Economy Screw Corporation, Chicago, Ill., a corporation of Illinois.

THE WATSON MACHINE COMPANY
PATERSON, NEW JERSEY, U.S.A.

ELECTRICAL WIRE AND CABLE AND WIRE ROPE MACHINERY



HIGH SPEED TUBULAR STRANDING HEADS "TH"

PLEASE NOTE:—

1. COMPACT DESIGN
2. RIGID CONSTRUCTION
3. DYNAMICALLY BALANCED ROTOR
4. SUPER-SENSITIVE ELECTRIC STOPS FOR FINEST WIRES
5. 3-SECOND AIR BRAKES
6. DOUBLE-GROOVED CAPSTANS
7. POSITIVE LAYS IN 11 TO 1 LAY RANGE
8. AUTOMATIC - AJUSTABLE SINGLE - SCREW TRAVERSE
9. TUNGSTEN - CARBIDE GUIDES
10. RIGHT & LEFT HAND ASSEMBLY (RIGHT HAND SHOWN)

A rectangular groove is formed longitudinally of the screw shank, across various portions of the screw thread.

✦ ✦ ✦

No. 2,302,689, SELF-TAPPING SCREW, patented November 24, 1942 by James J. Farrell, Scotia, N. Y., assignor to General Electric Company, a corporation of New York.

The screw body is provided with a tapered entering end comprising a conical surface with longitudinal ribs thereon, and a thread formed in the body and the ribs, the conical surface tapering to a diameter less than the root diameter of the thread at the entering end, and the ribs projecting from the conical surface to a height intermediate the root and crest diameters of the thread.

✦ ✦ ✦

No. 2,302,839, ELECTRIC CABLE, patented November 24, 1942 by Lynn S. Burgett, Euclid, Ohio, assignor to The Clark Controller Company, Cleveland, Ohio, a corporation of Ohio.

Multi-strand cables are provided, each with a central dielectric strand and a continuous flexible dielectric under one conductor and above the next adjacent conductor.

✦ ✦ ✦

No. 2,302,892, METHOD OF MAKING SPRING PACKING, patented November 24, 1942 by Charles T. Ripley and Walter M. Gibbs, Chicago, Ill., assignor to Spring Packing Corporation, Chicago, Ill., a corporation of Illinois.

A continuous method is provided of making coil spring-filled packing (of waste).

No. 2,303,005, NAIL HEADING MACHINE, patented November 24, 1942 by Karl E. Swangren, Chicago, Ill., assignor to Albert J. Deniston, Jr., Chicago, Ill.

The heads are formed of lead.

✦ ✦ ✦

No. 2,303,225, SCREW AND WASHER ASSEMBLY MACHINE, No. 2,303,226, WASHER FEED MECHANISM FOR SCREW AND WASHER ASSEMBLY MACHINES, and No. 2,303,227, SCREW AND WASHER ASSEMBLY MACHINE, patented November 24, 1942 by Carl G. Olson, Chicago, Ill., assignor to Illinois Tool Works, Chicago, Ill., a corporation of Illinois.

These patents cover devices for feeding screws, having shanks provided with enlarged portions adjacent the heads, and washers, for assembly of the same.

✦ ✦ ✦

"The Safety Clipper"

AMERICAN Optical Company of Southbridge, Mass., announces a new publication "The Safety Clipper" for use by editors of employee newspapers or magazines in promoting industrial safety. First issue has just been published, and editors are invited to send their names and addresses to the optical concern for addition to its mailing list.

✦ ✦ ✦

ALREADY favorably reviewed by editors and safety engineers, the publication is designed to provide editors with information, articles, cartoons, and editorials on the importance of industrial safety. By reprinting the materials appearing in the miniature newspaper, those in charge of employee publications can help persuade workers to use the goggles, protective clothing and safety devices supplied to them, thereby materially contributing to the success of the current safety drive sponsored by the Government, National Safety Council and industry.

✦ ✦ ✦

PERMISSION is not necessary to reprint any article or illustration that appears in the Safety Clipper. Electros or photos of the illustrations and cartoons are also supplied free of charge. No reference is made in any article or picture to American Optical Company's safety products, and neither is it necessary for editors to include a credit line—although the concern will be pleased if this is done.

FOR BETTER **WIRE** MAKE 1943 A

STEELSKIN YEAR

(Name Registered in U. S. Pat. Office)

"STEELSKIN" WIRE DRAWING COMPOUNDS ARE SCIENTIFICALLY DEVELOPED IN OUR LABORATORIES FOR HIGH AND LOW CARBON WIRE AND CAN BE DEPENDED ON TO GIVE HIGH DIE LIFE, TROUBLE-FREE RUNS AND FLAWLESS FINISH.

MAKERS OF COMPOUNDS FOR TUBING, STAMPING, DEEP DRAWING AND FOR WIRE.

R. H. MILLER CO., Inc.

HOMER, N. Y.

THIRTY-THREE YEARS EXPERIENCE

Coat Your Wire With "Steelskin"

Outstanding Personalities of the Wire Industry

American Steel & Wire Personnel Changes

THREE personnel changes in its staff at the main office in Cleveland have been announced by American Steel & Wire Co., subsidiary of U. S. Steel Corp.

✦ ✦ ✦

CECIL W. GUYATT, formerly assistant chief industrial engineer of the company, has been named chief industrial engineer.

✦ ✦ ✦

JOHN S. CONANT has been made priorities administrator, at the same time continuing as general supervisor of production planning. **Lloyd W. Hackley,** formerly supervisor of production planning in the cold rolled department at the Cuyahoga Works in Cleveland, has been appointed assistant general supervisor of production planning for the entire company.

H. J. Ruttenberg, Asst. Dir., Steel Division, War Production Board

THE appointment of **Harold J. Ruttenberg** as an Assistant to the Director of Steel Division of the War Production Board, effective as of December 1, was announced recently.

✦ ✦ ✦

IT will be Ruttenberg's responsibility to keep the Division Director informed as to labor's advice on matters within the jurisdiction of the Division. He will likewise be responsible for working out any problems arising in this field. ✦ ✦ ✦

IN addition Mr. Ruttenberg will serve as a member of the Production Directive Committee of the Steel Division. This Committee directs the product distribution and output of all steel producers and Mr. Ruttenberg will aid in assuring the best possible use of the manpower of the industry in the interest of the war effort.

✦ ✦ ✦

Personnel Changes at Lynn Plants Of General Electric Company

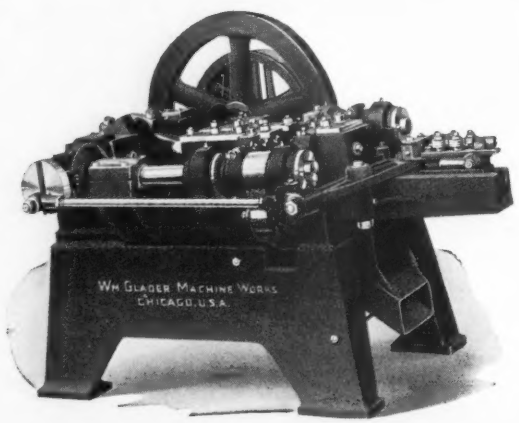
GEORGE M. STEVENS, since September 1940, assistant manager of General Electric's River Works at Lynn, Mass., has been named acting manager, and **Nicholas M. DuChemin,** formerly assistant manager of the West Lynn Works, has been named acting manager of that plant. Both Mr. Stevens and Mr. DuChemin succeed the late Nelson J. Darling who was manager of both plants.

✦ ✦ ✦

Philip M. Morgan, Director Wickwire Spencer Steel Company

IT was recently announced that **Philip M. Morgan,** president of the Morgan Construction Com-

HIGH SPEED WIRE NAIL MACHINE



WM. GLADER MACHINE WORKS

210 N. Racine Ave. Chicago, Illinois

Glader Machines on large head, single-blow roofing nails can be seen in operation at any of the independent wire mills in the United States.

The production figures on common nails shown below, are guaranteed.

SIZE MACH.	SIZE WIRE	MAX. LENGTH OF WIRE	NUMBER OF NAILS PER MIN.	CAP. IN POUNDS PER HR.
#00A	#16	1⅛"	700	37.2
#00	#14	1¼"	550	55
#0	#12	1¾"	450	89
#1	#10	2½"	400	192
#2	#8	3½"	325	310
#3	#4	5"	225	523
#4	#1	7"	190	622
#4s	5/16"	9"	175	1155
#5	⅜"	12"	160	2400

This high output and economical operation account for the GLADER machine being accepted as standard equipment in all recent installations.

pany, Worcester, Mass., has been elected as a director of the Wickwire Spencer Steel Company, New York, N. Y., as was David G. Baird, vice president of March & McLennen of New York City.

✦ ✦ ✦

George A. Lennox, General Sales Manager, Driver-Harris Company

GEORGE A. LENNOX, Assistant Sales Manager ,has been appointed General Sales Manager of the Driver-Harris Company, Harrison, N. J., manufacturers of special alloys.

✦ ✦ ✦

MR. Lennox has been with the Driver-Harris Company since 1907 and became District Sales Manager of the Chicago territory in 1917 and from that position was appointed Assistant Sales Manager, which position he held at the time of this present appointment.

✦ ✦ ✦

Harry Crump, Assistant Sales Manager, Carboloy Company, Inc.

HARRY CRUMP, who for the past 26 years has been associated with the General Electric Company at Schenectady, New York, has joined the Carboloy Company, Detroit, Michigan, as assistant to **K. R. Beardslee,** sales manager.

✦ ✦ ✦

WHILE at General Electric, Mr. Crump was development engineer on carbide tool applications and development at the central works laboratory.

✦ ✦ ✦

Joseph B. Shelby, Assistant Sales Manager, Driver-Harris Company

JOSEPH B. SHELBY has been appointed Assistant Sales Manager of the Driver-Harris Company, Harrison, N. J., manufacturers of special alloys. Prior to this appointment he was Manager of the Foundry.

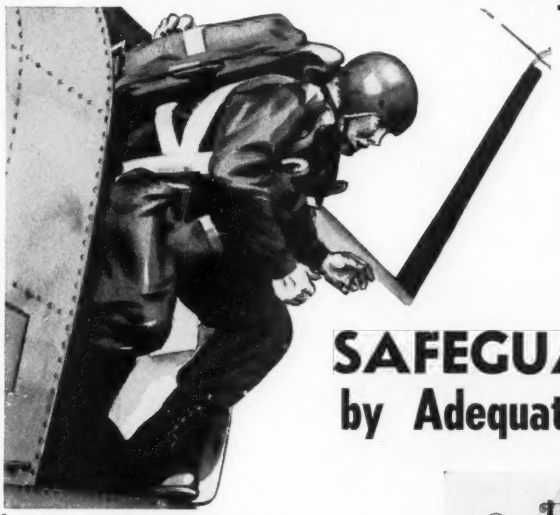
✦ ✦ ✦

DURING the First World War, Mr. Shelby served as Captain in the 31st Artillery Brigade CAC. Prior to the First World War Mr. Shelby was connected with the General Electric Company of Schenectady. In 1915 he became connected with the Driver-Harris Company as Sales Engineer.

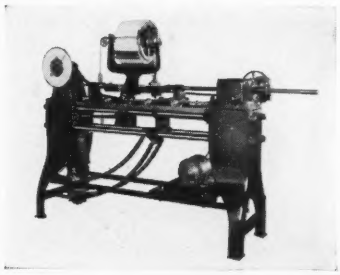
If You Are Not A Member Of The Wire Association
Now Is A Good Time To Join!
The Annual Dues Are $10.00

New Catalog Issued By B. F. Goodrich

CONTAINING simple, easy-to-read rules for the care and maintenance of steam hose, so vital now that rubber is so scarce, as well as detailed instructions on the proper methods to attach couplings, a revised catalog section on its lines of steam hose has just been issued by The B. F. Goodrich Company and is now available upon request to its principal offices in Akron, Ohio. Data on inside and outside diameters, weight and number of plies also are listed.



SAFEGUARDED
by Adequate Testing



Model Q-7
Scott Tester
Heavy duty wire tester with
capacity of 2,000 lbs.

The use of *Scott Testers safeguards your entire routine right through purchasing, manufacture and acceptance-inspection. Our machines are made in some 60 models, with capacities from the finest filament wires to 2,000 lbs. tensile. Numerous advantages are featured in Scott Testers, one of the most useful of which is recording of results on "picturized" charts which are easy to read and compare, and highly useful in facilitating acceptance. Let us send you bulletins.

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HENRY L. SCOTT COMPANY
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Standard of the World

New Heat Control

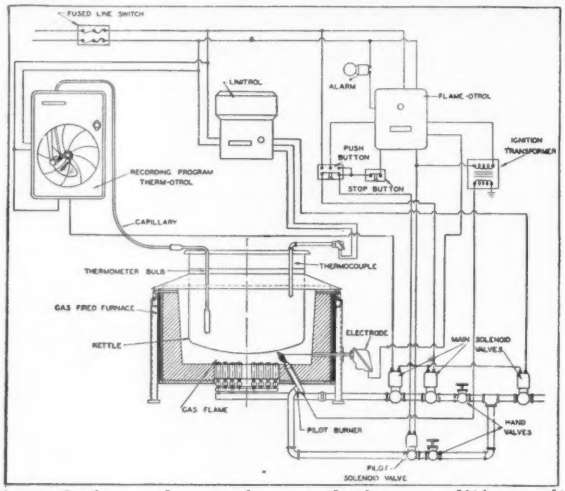
AN automatic temperature cycle or program control application for salt bath heat treatment, a pot-type furnace or a processing kettle, incorporating excess temperature shut-off and combustion explosion protection, is illustrated in the accompanying schematic drawing prepared by engineers of **Wheelco Instruments Co.**, Harrison & Peoria Sts., Chicago.

✦ ✦ ✦

THE instrument installation is designed to control fuel so as automatically (1) to provide the desired temperature at any period in the process regardless of temperature variations required; (2) to provide a record of temperatures experienced during the cycle; (3) to give excess temperature shut-off protection and protection against burning materials with low flash points, or in the event of fuel valve or instrument failure, and (4) to eliminate combustion hazards. It may be applied to gas or oil-fired equipment. Enforcement of any desired heating or cooling cycle, over any time period, is achieved by a Wheelco Recording Program Therm-otrol.

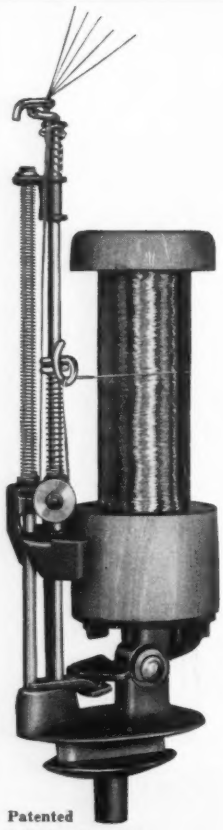
✦ ✦ ✦

WHEN the Therm-otrol calls for heat, a solendoid valve, shown schematically in the main fuel line just before the main burner, releases fuel that is ignited by a continuous pilot burner. When temperature has reached the level called for at that period in the process, the Therm-otrol closes the solenoid valve. The main burner goes out, but the pilot burner remains ignited.



✦ ✦ ✦

PROTECTION against pilot failure, which would present an explosive condition with ignition failure as the Thermo-otrol called for heat, is obtained through a Wheelco Flame-otrol. An alarm bell advises the operator when fuel is shut off.



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MULTIPLE ENDS OF FINE WIRES

A special design MOSSPEED CARRIER and BOBBIN is supplied for braiding "SHIELDED" WIRE & ETC.

Will braid multiple ends of fine aluminum, brass, bronze or copper wire, Etc.

SHEAVE-WHEEL on braider-stop and SPECIAL-THREADEYES on carrier, together with new type BOBBIN provides an even wire "let-off" resulting in a high quality and uniform braided shield.

Consult our engineers regarding your braiding problems.

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Ross Whitehead & Co., Ltd., Montreal and Toronto, Canada.

PROTECTION against possibility of valve or control instrument failure upsetting a process or treatment by overheating, or by heating above the flash point in the case of some materials, is obtained by a Wheelco Limitrol. This instrument, set a few degrees above the highest temperature called for in the process or treatment, is actuated through a thermocouple suspended in the furnace or kettle.

✦ ✦ ✦

Brazil's Exports and Imports

THE value of exports of plain and galvanized wire from Brazil in 1941 is reported by the press at 2,658,212 milreis (approximately $161,104). Exports during the preceding year were insignificant.

✦ ✦ ✦

IMPORTS of iron and steel plates into Brazil declined to 40,861 metric tons in 1941, from 50,412 tons during the preceding year.

✦ ✦ ✦

IMPORTS of iron pipes and tubing fell from 31,712 tons in 1940 to 29,180 tons in 1941, and tinplate from 66,740 tons to 59,469.

✦ ✦ ✦

Consumption License Required In Argentina

THERE is a comprehensive licensing system in Argentina, the press reports, for the consumption of iron and steel and products thereof, including pig iron, construction iron, black and white plate, tubes, and wire. A system of priorities also is being established.

✦ ✦ ✦

Booklets on Grinding and Abrasives

THE publication of a series of instructive books on grinding practices and the use of abrasives in industry has been announced by the **Norton Company**, Worcester, Mass.

✦ ✦ ✦

THE subjects covered follow:

1. **How to Increase Tool Life.**
2. **Grinding "Haynes Stellite" Cutting Tools.**
3. **Grinding Carbide Tipped Tools.**
4. **Norton Cut-Off Wheels.**
5. **Thread Grinding.**
6. **Abrasives and Grinding Wheels.**
7. **A Handbook on Tool Room Grinding.**
8. **Norton Grinding Wheels for the Tool Room.**
9. **Truing and Dressing.**
10. **The A B C of O. D. Grinding.**
11. **Facts About Metal Polishing.**
12. **Norton Abrasives for Portable Grinders.**
13. **A Primer on Grinding Wheel Safety.**
14. **Disc Grinding — A Production Operation.**
15. **Special Devices and Mechanisms for Standard Norton Machines.**
16. **What, Why and How.**
17. **Norton Grinding, Lapping and Super-Finishing Machines.**

COPIES of any or all of these booklets may be obtained free by addressing the Norton Company, Worcester, Mass.

If You Are Not A Member of The Wire Association — Now Is A Good Time to Join!
The Annual Dues Are $10.00—For detailed information address
RICHARD E. BROWN, Secretary
THE WIRE ASSOCIATION
300 Main Street, Stamford, Conn.

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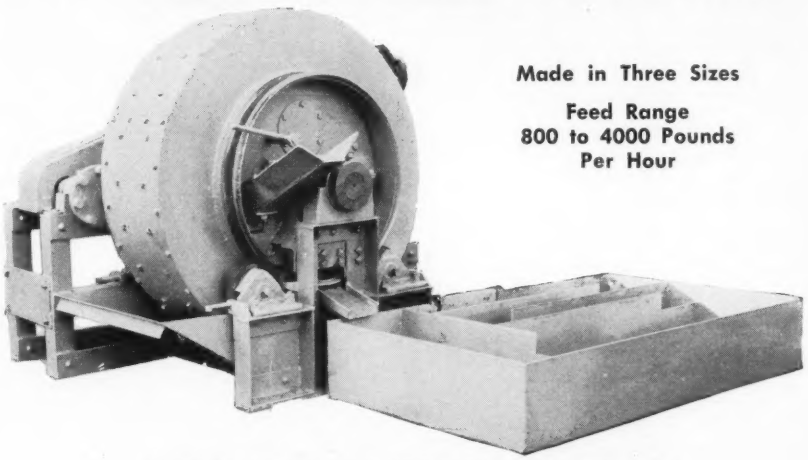
From POT and PAN BLANKET



Made in Three Sizes
Feed Range
800 to 4000 Pounds
Per Hour

A COMPLETE CONCENTRATING PLANT

Mills and Separates All Metal for Direct Re-melting, From Asbestos and Coal Blanket Skimmings

Save Scarce Metal for War and Make More Profits

Feed — No. 4 Size Mill, 800 to 1200 Pounds Per Hour
Power — 3 H. P. Direct "V" Belt Drive
Floor Space — 8'-1½"x9'-1½" Plus Space for Operator
Construction — All Steel

All Metal Milled Free Remains in Drum, the Waste Flows Into the Settling Tank. Water Recirculates Through the Mill.

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All sizes from .0006 to .102

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'Phone: Harrison 4319

New Books

THE Chemical Publishing Co., Brooklyn, New York, has published four new books of general interest:

✦ ✦ ✦

PLANT ENGINEER'S MANUAL, 231 pages, is a comprehensive reference book for all engineers responsible for the installation, operation and maintenance of industrial plant machinery and equipment, and covers sources of power, transmission of power, plant equipment, efficiency and so forth. Priced at $3.00.

✦ ✦ ✦

PRIVATE GENERATING PLANT, 151 pages, is a practical survey of the various types of generating plants now available and is of primary interest to electrical engineers and consultants. It covers types of plants, their installation and maintenance, and sells for $2.50.

✦ ✦ ✦

MACHINE SPEEDS AND FEEDS, 131 pages, is a collection of tables and data relating to machining operations on cast iron, steels and alloy steels, aluminum, aluminum alloys and other nonferrous metals, as compiled by Hayward-Tyler & Co., Ltd. It is especially designed for the guidance of machine operators tackling new jobs or new materials. The book sells for $2.25.

✦ ✦ ✦

TIN SOLDERS, By S. J. Nightingale and O. F. Hudson, 117 pages, is a modern study of the properties of tin solders and solder joints. An earlier edition appeared ten years ago in Great Britain.

✦ ✦ ✦

AMONG some of the subjects discussed are the elements of soldering, constitution of solders, plastic range, structure of solders, physical properties of solder alloys, strength of solder joints, creep properties. alloying between the solder and the jointed metals. Diagrams, tables, illustrations, photomicrographs are included. Priced at $2.75.

Alloy Steel Program for 1943

(*Continued from Page 45*)

IN 1936, we used 324,258 tons of chromite ore, all but 269 of which were imported from Africa, Cuba, the Philippines, and Turkey. This gives a fair picture of what we were up against when foreign supplies were threatened. By 1940, when war had broken out in numerous spots on the earth, consumption doubled over 1936, and imports increased ten times. But domestic production was still only 2,666 tons out of 657,689 tons total supply.

✦ ✦ ✦

TO meet military and essential civilian requirements in 1943, we will need about three times the tonnage used in 1939. And this includes cutting civilian needs to something like three per cent of the total.

✦ ✦ ✦

LARGE low-grade deposits of chromite ore have been developed in Montana, California and Oregon. These ores are not of high quality, but are adequate in an emergency. The Reconstruction Finance Corporation is providing over $10,000,000 for chromium projects, and private industry is adding several million more. The net result will be a domestic output in 1943 as large as imports in pre-war years.

✦ ✦ ✦

DESPITE increased domestic production, the situation remains critical. War needs will require more chromium this year than we used for all purposes in an average peacetime year. And next year, requirements again will be heavily increased.

✦ ✦ ✦

Molybdenum

MOLYBDENUM used to be a refreshing spot in the welter of materials shortages that followed on the heels of all-out war production, since we produce well over 85 per cent of the world's supply.

✦ ✦ ✦

MOLYBDENUM imparts some characteristics to alloy steels

(*Please turn to Page 82*)

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NORTON COMPANY
Worcester, Mass.

N-48

WIRE SPOOLING MACHINES

On Sticks or Spools . . . from Reels or Coils

Typical of FIDELITY Spooling Machines that you find serving every spooling-operation need of wire industry, these two new types command attention to advanced achievements in precision winding of the wire onto little flat sticks or conventional spools, at new high production rates and new low spooling cost.

You'll be interested especially in the new FIDELITY hydraulic control which eliminates gear changes . . . so write for Bulletin #61.

WIRE SPOOLING, TAPING, WINDING, SINFRA KNITTING, BRAIDING MACHINES

FIDELITY MACHINE COMPANY

3908-18 FRANKFORD AVENUE, PHILADELPHIA, PA.

Greatly improved results and production are now obtainable on difficult draws of high carbon wire through the use of a new dry drawing lubricant.

This product, Magnus 52-C-1 was developed for the job of drawing steel rope wire of 80 to 85 point carbon — 7 passes at speed of 700 feet per minute, starting at .079 with 83% reduction. The wire is then heat-treated and again drawn 7 passes at 1500 feet per minute, starting at .033 with a 90% reduction. Dies and blocks on both machines are water cooled.

The lubricants formerly used would not carry through for more than 6 passes at more than 500 feet per minute without "fish-tailing". This new Magnus Dry Drawing Lubricant carries through all 7 passes at the stepped-up production speed of 700 feet per minute.

Magnus 52-C-1 can be used either straight in the die box or with admixture of lime up to 30% lime to 70% lubricant.

Magnus 52-C-1 is only one of several special Magnus Wire Drawing Lubricants. Write today for additional information and a test sample of this new product. Or, let us make recommendations for the kind of wire you are drawing.

MAGNUS CHEMICAL COMPANY

Manufacturers of Cleaning Materials, Industrial Soaps and Metal Working Lubricants.

188 South Avenue — Garwood, N. J.

Magnus CLEANERS

Alloy Steel Program for 1943

(*Continued from Page 81*)

that no other metal does, although in many cases, other alloying metals are interchangeable. In the early stages of war production, molybdenum was widely substituted for tungsten, chromium, nickel, and other more scarce alloys. As is the case with any juggling of supply, a state of balance arrives very quickly, and the formerly plentiful metal becomes just as short as the ones for which it was being substituted.

✦ ✦ ✦

NORMAL domestic production was about twice the domestic demand, thus a large part of the production was exported. With the coming of the war and a curtailment of exports, there was an excess of production, which was carefully stockpiled.

✦ ✦ ✦

DOMESTIC supply will increase some 15 per cent in the year 1943 and in addition, new explorations are being carried out on old and new properties once thought too unproductive to work. If tests are favorable, some several million additional pounds will become available.

✦ ✦ ✦

Tungsten

IF the supply of tungsten (needed for cemented carbides as well as tool steel) is not sufficient for war needs, it is not because domestic production has been slipping. In 1939 we produced just over 3,600 tons of tungsten concentrates. By 1941 this had doubled, and this year will be doubled again. Imports spurted likewise. In 1939 we imported some 800 tons of the metal in 1940, over 2,800 tons.

✦ ✦ ✦

LARGE imports in 1940 and 1941 helped to build a stockpile for us, but with spread of the war to the Far East, Oriental supplies were cut off. Imports from this source for 1942 will be much less than in 1941. Production in Latin American countries is being stimulated, and for the duration of the war at least, Argentina,

Bolivia, Chile, Peru, Mexico will be our principal foreign sources of supply.

✦ ✦ ✦

IN the face of reduced imports from the Far East, strenuous efforts are being made by the U. S. Geological Survey, WPB, Bureau of Mines, Metals Reserve Company, and domestic producers, to locate and develop United States tungsten properties. A California deposit has been developed which will yield 17 per cent of the new tungsten this year. Another plant has been erected in Nevada which is producing almost as much.

✦ ✦ ✦

THE biggest United States development was the discovery by the Geological Survey of tungsten in the antimony-gold ores being mined in Idaho. This one property alone is currently producing 27 per cent of our tungsten.

✦ ✦ ✦

IN addition to the substitution of lower tungsten steels wherever possible, WPB has ordered (through Conservation Order M-14) that 75 per cent molybdenum type alloys must be used to fill high speed tool steel orders, only 25 per cent of a purchaser's orders being allowed to take tungsten alloys.

✦ ✦ ✦

ONE example of the many efforts to develop tool steels to conserve tungsten is a new alloy using 1 to 1.5 per cent tungsten and 9.5 per cent molybdenum, instead of the previous combination of 18 per cent tungsten, 4 per cent chromium, and 1 per cent vanadium.

✦ ✦ ✦

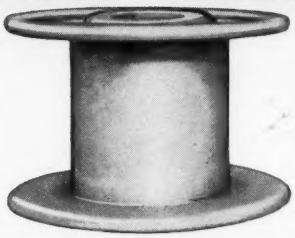
THE whole tungsten story adds up to a net shortage this year of somewhat over 10 per cent. Imports for 1943 cannot be predicted with accuracy.

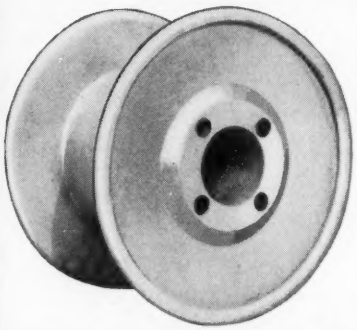
✦ ✦ ✦

THE hope of averting a shortage of tungsten lies in substitution of other metals in alloys, collection and proper use of tungsten-bearing alloy scrap, further domestic development, and maximum importation of all available foreign ores and metal.

(*Please turn to Page 84*)

FOR HIGHEST SPEEDS





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In 1943 and for the Duration

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The loyal Organization of the Company will continue its sincere efforts to cooperate with the great national program to Win the War.

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a partnership with but one purpose... to win the Victory! The times are tuned to "that which is essential." It is essential that exact records be kept on the production machines of the nation. It is essential that those production machines be equipped with Productimeters to assure accurate count. Ruggedly built to meet strenuous demands ...they prevent waste...conserve precious man-hours.

The line is complete, with models for measuring bare cable, insulated wire, armored cable, oily materials, etc. Wide range of speeds and capacities.

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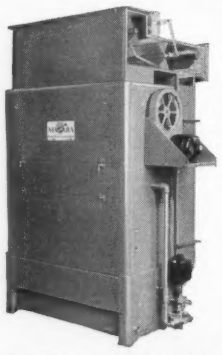


U. S. Patent No. 2,296,946

Alloy Steel Program for 1943

(*Continued from Page 83*)

Vanadium

VANADIUM is produced in these countries, in this order of importance: Peru, United States, Southwest Africa, Northern Rhodesia, Mexico. United States production has doubled since 1937, will be highest in history in 1942. Imports into the United States in 1942 are down somewhat from 1940.

✦ ✦ ✦

ONE large domestic producer is working with Metals Reserve Company on arrangements which will permit the mining of very low grade marginal ore which will yield an additional 2,200,000 pounds of vanadium. Government financial aid is being given mines whose ore is so low grade that it cannot be extracted at present prices.

✦ ✦ ✦

WPB officials do not expect a vanadium shortage, as such. We certainly need more than we have, but available supply is being dumped into the alloy hopper, where any shortage will be of all metals, and not of vanadium alone.

✦ ✦ ✦

IN 1943, further increased production, recovery of metal from flue ash, and miscellaneous small sources are expected to double 1942 available supply. Exact requirements for 1943 are not known, but if anticipated production is forthcoming, the shortage may become less critical than is now feared.

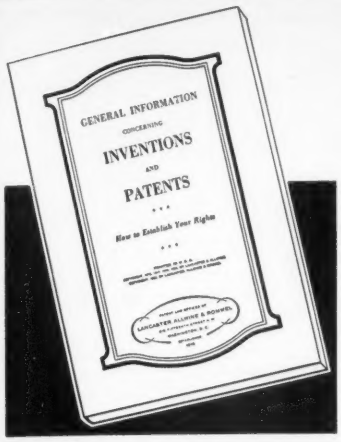
✦ ✦ ✦

Nickel

NICKEL is one of the oldest steel alloys, being found in the sword blades of ancient warriors. Exactly the same need for hardness, toughness, and corrosion-resistance that made nickel useful to the ancients make nickel essential for steel for armor plate, projectiles, tool steel, engine parts and guns.

✦ ✦ ✦

BESIDES alloying steel, nickel is needed urgently for cupro-nickel for condenser tubes, for heat-resisting alloys for heat-



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"Gilron" Coating Compounds increase drawing speed of stainless steel wire considerably. Multiple reductions can be drawn without recoating. Excellent results on welding wire.

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treating furnaces, for corrosion-resistant process units in chemical industries, and as a catalytic agent in production of synthetic rubber and high octane gasoline.

✦ ✦ ✦

WE do produce some nickel in this country, but only negligible amounts; two or three thousand tons of secondary metal recovered from scrap, and 500 tons or so of primary metal as a by-product of electrolytic refining of copper. Contrast this with Canadian production in 1939 of 102,000 long tons. New Caledonia produces about 10,000 tons, and Russia about 2,500 tons.

✦ ✦ ✦

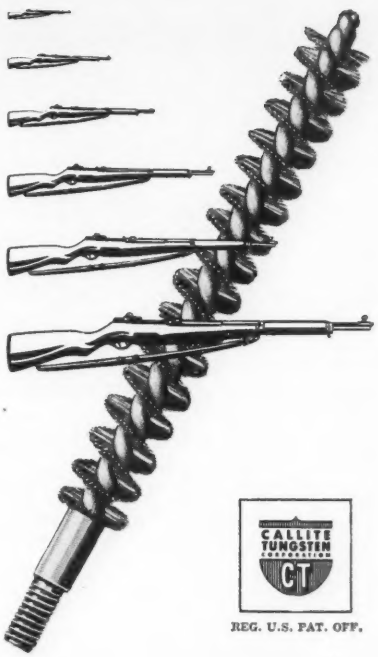
WAR needs for 1942 and 1943 are skyrocketing, and even with curtailment of unessential uses, maximum recovery of scrap, and highest possible production, serious shortages loom. Essential 1942 demand will run some four times that of 1938, and will jump to five times in 1943.

✦ ✦ ✦

THE principal means of overcoming the acute shortage lie in development of new sources, substitution for and combination with other metals, and more effective utilization of scrap. Explorations are being carried on in the United States by the Geological Survey and the Bureau of Mines, but so far have not uncovered any worthwhile deposits. Mining development loans have been made to further the development of two projects—one in Colorado and one in Washington. But production from these mines is not expected to be large.

✦ ✦ ✦

THE most significant possibility of expanding our supply is increasing nickel imports from Cuba. A subsidiary of a United States corporation has secured $20,000,000 aid from the Reconstruction Finance Corporation to treat Cuba ores by a special process developed for the treating of low grade manganese ores. The concentration of nickel in Cuban ore is low; it is expensive and difficult to extract; but our need for nickel is so great that even comparatively sparse sources are being called upon.



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Another Callite Fine Wire Application

The use of wire in gun-cleaner brushes isn't exactly a dramatic application, is it? You're right!

But the Mill-Rose Company, one of the country's largest manufacturers of gun cleaner brushes, will tell you that there's more than meets the eye in this application. . . . That gun cleaner brushes are an important combat implement, and therefore, must be produced with the same precision and care that is expended on far more exciting devices.

That is why Mill-Rose Company specifies Callite for fine wires for their gun cleaner brushes.

If you have a product that demands uncompromising wire quality, uniformity in tolerance and finish, consult Callite. Our engineers will be glad to assist you in determining the proper wire type for your specific application. Callite Tungsten Corporation, 557-39th Street, Union City: New Jersey. Branch offices: Chicago, Cleveland.

Callite Fine wires in sizes as small as .002" can be furnished in the following metals and alloys for springs, control cables, brushes, wire cloth and other applications.

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ARE YOU DRAWING ROPE, FENCE, NAIL OR REED WIRE?

Concerns doing this work have found that by boiling wire in a solution of Oakite Composition No. 24 before certain subsequent operations, many advantages are obtained that contribute to improved product, shorter time in baking, elimination of rust spots, brighter surfaces.

Our services are freely at your disposal in making tests to see how you can adapt Oakite Composition No. 24 successfully to your type of work. There is no obligation . . . write today.

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Whoosis for President

(*Continued from Page 39*)

the age of miracles is not over. Something in our set-up may warrant divine intervention in the awful liquidation foreshadowed by history. That reminds me of the story of the hermit. Have you heard it? No? Then I'll tell it to you to wind up this session on a lighter note.

✦ ✦ ✦

IN a commodious cave hard by the shores of a beautiful lake, there dwelt, in the odor of sanctity, a pious hermit, whose days were spent in meditation and good works, and whose nights were spent in prayer. Once a year, in the genial heat of July, the hermit was wont to repair for an hour to the shallows of the lake, there to refresh his wasted body in the cool waters, and at the same time to wash his simple garments.

✦ ✦ ✦

ON one of these occasions, as he stood knee-deep, his garments afloat on the ripples at his feet, he was horrified to see, approaching the shore, a beautiful maiden. In spite of his infirmities he reached the shore in one bound, seized his old straw hat in both hands, and clapped it over that spot which he though might most offend. Then he raised his eyes, and to his unspeakable horror saw that the young maiden, whose toilet was far advanced, and who apparently planned to join him in the lake, had grasped by the back of the neck, and was about to remove, what might well be her only remaining garment.

✦ ✦ ✦

INSTANTLY he clapped both hands to his eyes, forgetting that they were engaged in holding the hat. In a split second the horror of his situation burst upon him, and in this split second he prayed fervently that he might be saved from any offence. The Lord heard his prayer, and vouchsafed to him a miracle. The hat did not fall.

✦ ✦ ✦

NOW, son, it's nice to have seen you, come any time, but you'll have to be pushing along now because it's my bed time. I believe

If you MAKE or USE WIRE YOU NEED ONE OF THE MANY

Porter Cutters

Indispensable in wire mills for sampling large wire.

In almost universal use by wire fabricators for cutting reinforcing fabric, fencing, spring wire, etc.

Useful in any plant—large or small—for all sorts of maintenance and repair work—for cutting bolts, rods, wires, rivets, wire rope, chains, or for splitting deformed or "frozen" nuts.

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Send for Catalog of PORTER CUTTERS.

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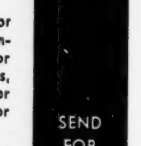

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3 shears for **CUTTING** bars up to 3" diameter.

3 Machines for **BENDING** bars up to 1½" diameter.

3 WIRE STRAIGHTENING machines for #14 gauge wire to 9/16" wire rod; lengths up to 25'.

Spot and Arc WELDING equipment.

Our regular business in reinforcing steel will be continued and our usual type of service furnished.

CAPITOL STEEL CORP.
of N. Y.
STEEL FOR CONCRETE
15 E. 40 St., New York, N. Y.
MU. 3-7479
Jersey City—Baltimore—San Juan

I've answered your question. By my frank statements at various times I have alienated practically every large group of morons in the United States. That last story finished off the church members. If there is any group I have neglected to tick off, let me know and I'll take care of them.

✦ ✦ ✦

I WOULD draw some complimentary votes from the Wire Industry, some from the N. A. M., and the U. S. Chamber of Commerce, a few old survivors of the age of industrial giants would hobble out of the Union League to mark a cross for me. But even if I were elected I'd be picked off before I could get to Washington, because I'm one of those outmoded folks who call them just as they see them. I hate labor unions, I claim that they have accomplished nothing but confusion and brigandage, and that such improvements as they claim to have forced in conditions of labor were merely contemporary, not cause and effect. I distrust and despise the whole social security program as a device to assist in the propagation of the unfit to the disadvantage of those we should leave unshackled. I doubt that safety and freedom can co-exist, and suspect that they hang from opposite ends of the see-saw, that when you snatch at one you must forego the other, and that there is a lively prospect of losing both. I am not politically available, and I know it.

✦ ✦ ✦

I SHALL reply to you as General Sherman replied on a similar occasion. "If nominated I should refuse to run; if elected I should refuse to serve."

✦ ✦ ✦

GOOD night, and mind the step.

This is an invitation for you to become a member of The Wire Association. ✦ ✦ ✦ ✦ ✦ ✦

The Annual Dues are $10.00

✦ ✦ ✦

For Details Address

Richard E. Brown, Secretary
The Wire Association
300 Main St., Stamford, Conn.
Tel: Stamford 3-0482

Wartime

Wire for a thousand uses

Versatile Continental wire is produced in sizes from 34 gauge to 5/8 inch, in standard and special shapes . . . and in a wide range of analyses, tempers and coatings.
CONTINENTAL STEEL CORP., KOKOMO, INDIANA
(The Superior Sheet Steel Co., Canton, Ohio — a subsidiary)

CONTINENTAL STEEL CORPORATION ★ SUPERIOR WIRE

CONTINENTAL SUPERIOR STEEL

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SHEETS: Black, Galvanized, Copperior, Hot and Cold Rolled, Special Coated, Long Terne, etc

WIRE: Bright Basic, Annealed, KONIK, Coppered, Tinned, Special Manufacturer's, etc.

WIRE MACHINES FOR

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"American" INSULATING MACHINERY COMPANY

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For Rubber Covered Wire Ball Bearing

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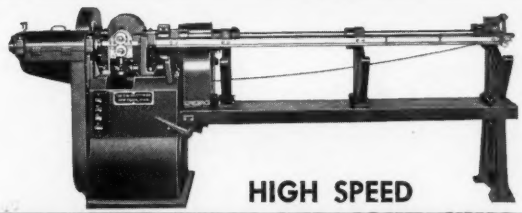

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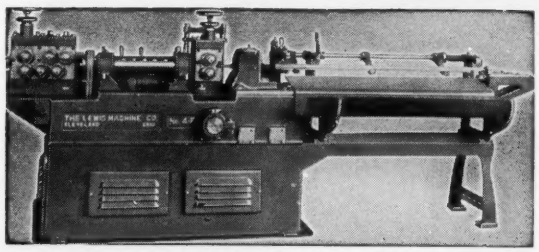

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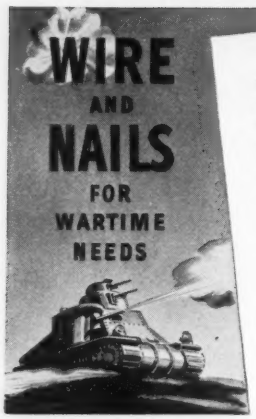

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Wire is so precious in wartime that it becomes almost a national duty to make sure that you make the right selection on whatever wartime work you may be handling. Cortland Wire and wire products always do a "right" job. Bright—Annealed—Coppered—or Galvanized. Coiled or Straightened and cut to length—in all sizes. And remember that the companion product to Cortland Wire is Cortland Nails—Bright, Cement Coated, or Coppered. Smooth or barbed. Specials for nail machines—diamond, needle, and duckbill points. More than ever, it pays to specify Cortland-Wickwire.

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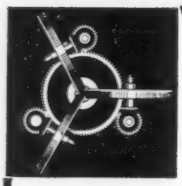

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FOR LINEAR MEASURE

PROVIDES NEW STANDARD OF ACCURACY

Illustration Shows Exclusive Patented "3V" Principle

Measuring twisted, armored, bare or insulated wire without vibration or inaccuracies at any speed or varying speeds!

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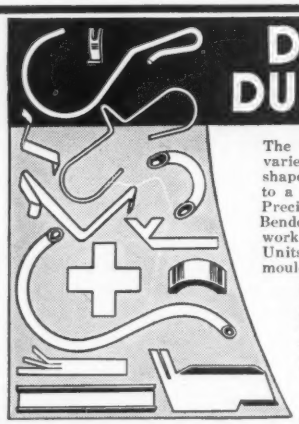

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The parts shown are typical of the variety of simple or intricate forms and shapes which can be quickly duplicated to a tolerance of .001" with DI-ACRO Precision Machines — Shears, Brakes, Benders. For experimental and research work or production runs, DI-ACRO Units form angle, channel, tube, rod, moulding, wire, strip stock; shear stock sheets, trim duplicated stampings. With DIE-LESS DUPLICATING, Man Hours and Critical Materials are frequently saved. Send for Catalog —

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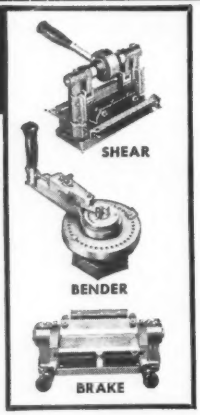

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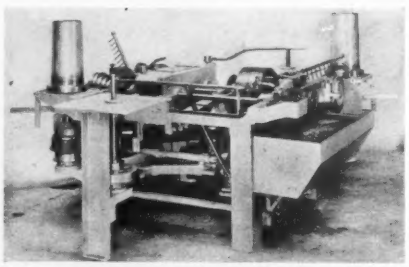
CONTINUOUS WIRE DRAWING MACHINES



for high carbon wire, with provision for ten drafts.

Equipped with rewind attachment with drums up to 16" in diameter.

Also makers of other wire drawing machines, wire mill accessories such as straighteners, pointers and water cooled die holders, and special machinery.

SUPERIOR TOOL AND MANUFACTURING CO.
172 UNION STREET • WORCESTER, MASSACHUSETTS

Some Interesting War Viewpoints From Correspondents

(*Continued from Page 75*)

Middle East, in India, in Asia, and WE HAVE A JOB TO DO DOWN HERE—DON'T LET ANYONE FOOL YOU. You can imagine by looking at the map that IF the Japs COULD invade and completely dominate Australia, just how many years longer the War would last.

Now let me hear from you—what's going on, and how're your folks and what are you doing? Are you making up anything in your neck of the woods for War use that you think that we could make down here to supply to War Departments? Remember, there's a terrific amount of American Equipment down here that has to be serviced, repaired, and kept in good working order all the time. How's about you sitting down and dropping me a note to let me know the gossip from your neck of the woods?

With the very warmest good wishes.

✦ ✦ ✦

New Heat Treating Temperature Control Measures and "Adds" Heat to Salt Baths

A NEW temperature control for salt bath heat treating which measures and adds the correct amount of power for the proper interval and even corrects the operator for any error on his part in setting the control is announced by **Upton Electric Furnace Div.**, 7450 Melville Avenue, Detroit, Michigan.

✦ ✦ ✦

ACCORDING to the manufacturer, exceptionally accurate temperature control is being had with the new device. It is foolproof and simple to operate.

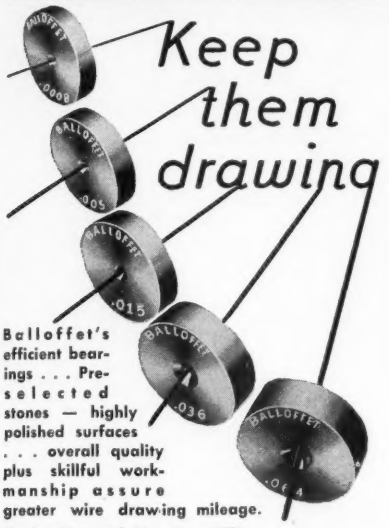
✦ ✦ ✦

THE equipment consists essentially of a panel stand on which is mounted pyrometer, timer, ammeter and signal light. Below the panel is a cabinet with three heat selector levers. A foot operated circuit interlock "unloads" the hand lever switches to avoid burning of their contact points when a change in heat selection is being made.

✦ ✦ ✦

WHEN the work goes in the bath, the operator touches the "start" button on the panel and the control takes over. When the time is completed, the current drops back to the "holding" value, and the signal light flashes on and warns the operator to remove the completed work.

Balloffet
DIAMOND DIES



Balloffet's efficient bearings . . . Preselected stones — highly polished surfaces . . . overall quality plus skillful workmanship assure greater wire drawing mileage.

Quality Diamond Dies since 1870

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Wire Drawing and Extrusion Dies made of
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Wire Drawing Diamond Dies
COCHAUD
WIRE DIE CORPORATION
300 W. 56th St., NEW YORK
Tel. Col. 5-1340

THE entire control and stand occupies eight square feet of floor space and can be placed to the operator's convenience.

✦ ✦ ✦

Wire Association Proceedings

(*Continued from Page 63*)

as a comparison, the same material was electrically treated and lead quenched.

A Member: The point J meant was that particular material was very low in hardenability of that particular heat involved.

Mr. Zur: We obtain a tensile that is considerably higher by resistance heating and lead quenching, also the reduction in area is considerably higher on the same steel electrically patented.

A Member: It would still be a very low hardenability for a spring wire heat.

Mr. Zur: That's right, on the basis of 29% reduction.

The Convention then adjourned.

✦ ✦ ✦

Wire Products Simplified to Save Steel

TO aid the production of barbed wire, wire fencing. and poultry netting needed to protect farm properties, crops, and livestock, the WPB November 12 prohibited the manufacture of nonessential types and styles of such wire products.

✦ ✦ ✦

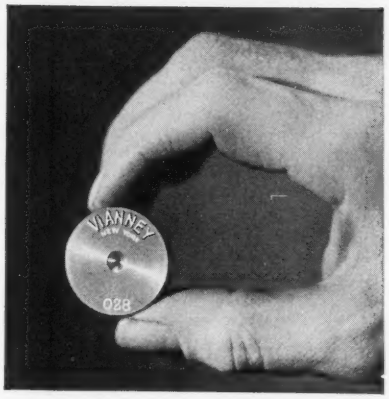
A NEW schedule, No. 3 to Limitation Order L-211 will permit the manufacture of only 1 type of barbed wire, compared with 8 styles usually obtainable, and reduce from more than 100 to a very few the permitted types of fencing, netting, and flooring.

✦ ✦ ✦

THE new schedule is expected to result in a direct saving of steel by enabling a greater amount of wire to be made per ton of metal. In addition, the schedule will result in the corollary advantages of most simplification programs — reduction in inventories, an increase of the operating efficiency of machines, and conservation of machine-time and labor.

DIAMOND AND CARBIDE WIRE DRAWING DIES
RUSCH WIRE DIE CORPORATION
275 Seventh Ave., New York, N. Y.

VIANNEY
Famous Wire Drawing Diamond Dies



These famous Diamond Dies are now produced here at moderate prices.

All sizes are in stock or made to order to your specifications

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DIES
Compare Quality and Prices and You'll Specify "AJAX"
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Manufacturers of
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(Galvanized to U. S. Specifications)
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Rod Frames — 16" Frames, 8" Frames — Take-Up Frames, Wire Pointers — Puller Tongs.
General and heat resisting alloy castings for wire mill use.
Circulars on Request.
E. J. SCUDDER FOUNDRY & MACHINE CO.
TRENTON, N. J.

"NEP" — SUMFOAM INHIBITORS
THE WILLIAM H. PARKIN CO.
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ORDER YOUR COPY NOW—
LIMITED EDITION

Diamond and Gem Stone Industrial Production

PAUL GRODZINSKI

PRICE $5.00

The use of diamonds and gem stones as dies for fine wire drawing, and of diamonds for cutting tools, is comparatively recent. Today it is extensive and increasing. In this book the author has brought together all the data and information available on the subject and has added the results of his own experience and research. Although dealing mainly with the actual production of the dies and tools, the knowledge this book imparts is of prime importance to tool users. Efficiency and economy in the use of diamond and gem stone dies and tools is not possible without a knowledge of production methods.

✦ ✦ ✦

There are reference tables and a large number of specially drawn illustrations included in this book. An endeavor has been made to leave no phase of the subject untouched.

MAIL YOUR ORDER TODAY

WIRE & WIRE PRODUCTS
300 MAIN ST. STAMFORD, CONN.

Saving Diamond Dust

A SIMPLIFIED method has been devised for recovering diamond dust, according to **C. B. Shopmyer** of General Electric's Schenectady works laboratory. Among the widespread applications of diamond dust in industry is that of polishing wire-drawing dies made of tungsten carbide, one of the hardest compounds yet devised by science. Such dies are used in drawing copper wire and rod from 0.0641 to 7/8 inch diameter.

✦ ✦ ✦

DIAMOND dust may be used over and over again, but recovery is a problem. During polishing, the dust falls into a receptacle with oil, tungsten carbide and cobalt particles, bristles, and bits of cloth. The recovery process ordinarily requires large amounts of acids which destroy everything but the diamond dust, but Mr. Shopmyer recently devised a greatly simplified method. The new method requires only small amounts of chemicals, and the process can be completed by technicians in half the time.

✦ ✦ ✦

LIKE other organizations which operate wire-drawing machines, General Electric buys diamonds in dies. A hole from .0025 to 0.0641 inch diameter is already drilled in the diamond, and the diamond imbedded in the center of a metal die shaped like a thick coin. Several dies, each having a slightly smaller hole in the center, are placed in each automatic wire-drawing machine. After several thousand pounds of wire have been drawn, the diamonds show signs of wear. They are then re-drilled to a larger size for re-use. Like a librarian checking out a new book, the die maker then stamps the measurement of the new size on the die.

✦ ✦ ✦

AFTER several re-borings, however, the diamond becomes too large for drawing small wire. Then the die may be dissolved chemically and the diamond removed. The diamond is crushed into dust, which in turn is sifted through an extremely fine sieve.

GEORGE D. HARTLEY
CONSULTANT & SPECIALIST
In Wire Manufacturing & Wire Forming Equipment
Development & Research
New Processes — Designing
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372 MAY ST., WORCESTER, MASS.

KENNETH B. LEWIS
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Wire Mill Equipment, Layout and Practice
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DRAWING LUBRICANTS
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READING, PA.

Hy-Carbo Steel Co.
EST. 1917
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EQUIPMENT AVAILABLE FOR REDRAWING ROUND WIRE
Less Ton Lots A Specialty
✦ ✦ ✦
LOWELL, MASS.

ZINC STRIP AND WIRE
THE PLATT BROS. & CO.
WATERBURY, CONN.

Manufacturers of materials, tools and equipment for wire drawing and forming plants are constantly making improvements and additions to their lines. If you do not find the product or service in which you are interested, additional information will be supplied promptly. Simply address:

WIRE & WIRE PRODUCTS
300 Main St. Stamford, Conn.

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PATERSON N J
BUILDING EXTRUDERS SINCE 1880

Royle insulating, straining and tubing machinery --- famous fifty years.

JOHN ROYLE & SONS
PATERSON, N. J.

British Agency: James Day (Machinery) Ltd.,
The Grange
Whetstone
Nr. Leicester, England

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SPARKERS
R. L. DAVIS ELECTRIC CO.
340 Center Street,
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For Rolling and Annealing Ferrous and Non-Ferrous Metals
W. S. ROCKWELL Co.
50 Church St. New York

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and
SPECIAL MACHINERY
Address inquiries to
ROBERT J. EMORY COMPANY
Sherman Ave & Runyon St.
Newark, N. J.

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for
WIRE INDUSTRY
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LYNN, MASSACHUSETTS
WRITE FOR CATALOGUE

Sifting guarantees uniformity of diamond dust particles.

✦ ✦ ✦

SIFTED and graded, the dust is ready for polishing tungsten-carbide wire-drawing dies. These dies are used in drawing larger size wire and even rods — from 0.0641 to 7/8 inch in diameter. By means of Mr. Shopmyer's method, the dust can then be recovered and re-used for the same purpose.

✦ ✦ ✦

Instructive New Booklet on Roll and Cylindrical Grinders

OPERATING and engineering executives responsible for the accuracy and finish of ground rolls, cylinders and shafts will find information of practical value in a comprehensive booklet just issued by **Farrel-Birmingham Company, Inc.**, Ansonia, Connecticut.

✦ ✦ ✦

THIS booklet describes the design, construction and operating advantages of the Farrel Type TT Roll Grinder with moving work table. This machine was developed for high output of precision ground rolls with a minimum of skill on the part of the operator. Many new features assure accuracy in setup and operation. The machine will grind rolls with either straight, concave or convex contours to predetermined standards of accuracy and finish. A patented attachment fro grinding tapers can be incorporated in the machine when it is built or it can be added after the the machine is installed.

✦ ✦ ✦

FARREL Type TT Roll Grinders are built in three sizes, to take maximum diameters of 24", 28" and 32" and in any length required. The bulletin tabulates specifications, dimensions and weights for each of the different sizes. Standard equipment and optional attachments are described and electrical equipment requirements given. Photographs, diagrams and drawings illustrate the features of the machine.

✦ ✦ ✦

THIS bulletin is of timely value just now with the expanded demand for machines which aid in the production of uniformly accurate rolled sheets and strip. Copies will be sent upon request addressed to the company.

FOR SALE

The following Cold Rolling Mills:

2—Bliss Mills

4—Broden Mills

Driven by DC variable speed motors through gear reducers. Rolls 8" diameter 5" face, water cooled and roller sleeve bearings. Motors 15-20 H. P., 230 Volts, 500 to 1500 RPM, variable speed.

2—Broden mills same as above except rolls 8" diameter by 5½" face, and Chain Driven.

All mills equipped with one take-up for each two mills. Also all mills equipped with edge rolls. Also all in first class operating condition. Address Box #339, c/o

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HELP WANTED

Welding rod specialist thoroughly experienced in all phases of manufacturing coated welding rod. Selling experience desirable, but not essential. State experience fully, also salary desired. Address Box #340 c/o

WIRE & WIRE PRODUCTS

WANTED

Man, middle-aged, with full knowledge of Wardwell braiders and saturants, as assistant manager of small plant, Baltimore, Md., manufacturing non-metallic sheathed cable, armored cable and war specialties. Must be handy mechanic, long on common sense. Willing to work now for possibilities in post war era. Excellent opportunity. State age, nationality, experience and salary expected. Address Box #341, c/o WIRE & WIRE PRODUCTS.

POSITION WANTED

Young metallurgist with twelve years of steel and wire mill experience desires permanent metallurgical or operating department position in wire industry. Draft classification 3-B. Address Box #342

WIRE & WIRE PRODUCTS

RUESCH
Machinery For
Wire, Tube, and Brass Mills
409 Mulberry St., Newark, N. J.

SC Designers and Builders of Gas-Fired Heat Treating Furnaces for Ferrous and Non-Ferrous Wire.
SURFACE COMBUSTION
Main Plant & General Offices - Toledo, Ohio

WIRE MACHINERY SPECIALISTS

3—Nilson No. 1, 3 & 4 4 Slide Wire Machines
5—Baird No. 4—Four Slide Wire Machines
7—Waterbury Step Cone Wire Drawing Machines
1—Two Spindle Bull Block Motor Driven
6—Lewis Welding Wire S. & C. Machines M. D.
2—Shuster Shaped Wire S. & C. Machines ½" & ⅞" Square, Hexagon & Round Stock Capacities
8—Shuster Round Wire Straightening & Cutting Machines 1/32"-½"

Wanted: Tack Making Machinery. All Sizes.

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128-138 MOTT ST. NEW YORK, N. Y.

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WHERE TO BUY

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ABRASIVES—
Norton Co., Worcester, Mass.

ACID INHIBITORS—
American Chemical Paint Co., Ambler, Pa.

AIR DRAW FURNACES—
Carl-Mayer Corp., The, Cleveland, Ohio.

ALKALINE CLEANERS—
American Chemical Paint Co., Ambler, Pa.

ANNEALING MACHINES—Open Flame
Syncro Machine Co., Rahway, N. J.

ANNEALING POTS AND BOXES—
National Annealing Box Co., Washington, Penna.
Scudder, E. J., Foundry & Machine Co., Trenton, N. J.

ARMORING EQUIPMENT—
American Insulating Mach'y Co., Phila., Pa.
New England Butt Co., Providence, R. I.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Rahway, N. J.
Watson Machine Co., Paterson, N. J.

BAKERS—Hi-Speed
Carl-Mayer Corp., The, Cleveland, Ohio.

BAKERS—Rod and Wire
Carl-Mayer Corp., The, Cleveland, Ohio.
Morgan Construction Co., Worcester, Mass.
Moslo Machinery Co., Cleveland, Ohio.
Ross, J. O., Engineering Corp., New York, N. Y.

BARRELS—Air Blast
Dreisbach Engr. Corp., Yonkers, N. Y.

BENDERS—
O'Neil-Irwin Mfg. Co., Minneapolis, Minn.

BERYLLIUM COPPER — Strip and Bars
Callite Tungsten Corp., Union City, N. J.

WHERE TO BUY, Continued

BOBBINS—Braider and Wire Weaving
Apco Mossberg Co., Attleboro, Mass.
Hubbard Spool Co., Chicago, Ill.
Mossberg Pressed Steel Corp., Attleboro, Mass.

BORON CARBIDE—
Norton Co., Worcester, Mass.

BRAKES & SHEARS—
O'Neil-Irwin Mfg. Co., Minneapolis, Minn.

CABLE LACQUERING OVENS—
Industrial Oven Engr. Co., Cleveland, Ohio

CARRIERS—Braider, High Speed
Apco Mossberg Co., Attleboro, Mass.
Mossberg Pressed Steel Corp., Attleboro, Mass.

CEMENTS—Refractory
Norton Co., Worcester, Mass.

CHEMICALS—Cleaning
American Chemical Paint Co., Ambler, Pa.
Magnus Chemical Co., Garwood, N. J.
Oakite Products, Inc., New York, N. Y.
Parkin, Wm. M., Co., The, Pittsburgh, Pa.
Standard Industrial Compounds Co., Chicago, Ill.

CLEANERS—Hand and Metal
American Chemical Paint Co., Ambler, Pa.
Magnus Chemical Co., Garwood, N. J.
Oakite Products, Inc., New York, N. Y.
Standard Industrial Compounds Co., Chicago, Ill.

CLEANING & PICKLING EQUIPMENT—
Broden Construction Co., Cleveland, O.
Cleveland Tramrail Div. of the Cleveland Crane & Engineering Co., Wickliffe, Ohio.
Morgan Construction Co., Worcester, Mass.
Nukem Products Corporation, Buffalo, N. Y.
Vaughn Machinery Co., Cuyahoga Falls, O.
Wilson, Lee, Engr. Co., Cleveland, Ohio.

CLOTH TESTERS—
Scott, Henry L., Co., Providence, R. I.

CLOTH—Wire, All Metals
Callite Tungsten Corp., Union City, N. J.

COATING COMPOUNDS—
Gilron Products Co., Cleveland, Ohio

COILERS—Sheet, Strip and Wire
Broden Construction Co., Cleveland, O.
Ruesch, H. J., Machine Co., Newark, N. J.
Torrington Manufacturing Co., The, Torrington, Conn.

COLD HEADERS—
Ajax Manufacturing Co., Cleveland, O.
Waterbury-Farrel Fdry. & Mach. Co., Waterbury, Conn.

COMPOUNDS—Coppering
American Chemical Paint Co., Ambler, Pa.

COMPOUNDS—Metal Finishing
American Chemical Paint Co., Ambler, Pa.

COMPOUNDS—Rust Preventing
American Chemical Paint Co., Ambler, Pa.

COMPOUNDS—Rust Removing
American Chemical Paint Co., Ambler, Pa.

COMPOUNDS—Wire Drawing
Gilron Products Co., Inc., Cleveland, Ohio.
Oakite Products, Inc., New York, N. Y.
Richards, G. Whitfield, Philadelphia, Pa.
Standard Industrial Compounds Co., Chicago, Ill.

CONTROLS—Heat Treating
Niagara Blower Co., Buffalo, N. Y.

CONTROLS—Temperature
Niagara Blower Co., Buffalo, N. Y.

COPHOLDERS—Steel
Apco Mossberg Co., Attleboro, Mass.
Hubbard Spool Co., Chicago, Ill.
Mossberg Pressed Steel Corp., Attleboro, Mass.

CRANES—Wire Mill
Cleveland Tramrail Div. of the Cleveland Crane & Engineering Co., Wickliffe, Ohio.
Morgan Construction Co., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.

CUSTOM WIRE DRAWING—
Hy-Carbo Steel Co., Lowell, Mass.

CUTTING TOOLS—Carbide
Carboloy Co., Inc., Detroit, Mich.
Firth-Sterling Steel Co., McKeesport, Pa.
Vascoloy-Ramet Corp., North Chicago, Ill.

CUTTING TOOLS—Wire
Porter, H. K., Inc., Everett, Mass.

DIAMONDS—Industrial
Callite Tungsten Corp., Union City, N. J.

DIAMOND POWDERS—
Rusch Wire Die Corp., New York, N. Y.

DIAMOND TOOLS—
Rusch Wire Die Corp., New York, N. Y.

DIE MAKING MACHINERY — For Forming Special Shapes
O'Neil-Irwin Mfg. Co., Minneapolis, Minn.

DIES—Diamond
Ajax Industrial Supplies, Inc., Fort Wayne, Ind.
Balloffet Dies & Nozzle Co., Inc., Guttenberg, N. J.
Cochaud Wire Die Corp., New York, N. Y.
Fort Wayne Wire Die, Inc., Fort Wayne, Ind.
Indiana Wire Die Co., Fort Wayne, Ind.
Kelly Wire Die Corp., New York, N. Y.
Krause, F., & Co., Hillside, N. J.
Luginbill Wire Die Co., Fort Wayne, Ind.
Rusch Wire Die Corp., New York, N. Y.
Vianney Wire Die Works, New York, N. Y.
Wayne Wire Die Co., Hillside, N. J.

DIES—Lead Extrusion
Robertson, John, Co., Brooklyn, N. Y.

DIES—Repairs & Re-Cutting
Ajax Industrial Supplies Co., Fort Wayne, Ind.
Balloffet Dies & Nozzle Co., Inc., Guttenberg, N. J.
Carboloy Co., Inc., Detroit, Mich.
Cochaud Wire Die Corp., New York, N. Y.
Firth-Sterling Steel Co., McKeesport, Pa.
Fort Wayne Wire Die, Inc., Fort Wayne, Ind.
Kelly Wire Die Corp., New York, N. Y.
Krause, F., & Co., Hillside, N. J.
Luginbill Wire Die Co., Fort Wayne, Ind.
Rusch Wire Die Corp., New York, N. Y.
Vascoloy-Ramet Corp., North Chicago, Ill.
Vianney Wire Die Works, New York, N. Y.
Wayne Wire Die Co., Hillside, N. J.
Willey's Carbide Tool Co., Detroit, Mich.

DIES—Rod and Tube Drawing
Balloffet Dies & Nozzle Co., Inc., Guttenberg, N. J.
Carboloy Co., Inc., Detroit, Mich.
Firth-Sterling Steel Co., McKeesport, Pa.
Kelly Wire Die Corp., New York, N. Y.
Rusch Wire Die Corp., New York, N. Y.
Tungsten Electric Corp., Union City, N. J.
Vascoloy-Ramet Corp., North Chicago, Ill.
Vianney Wire Die Works, New York, N. Y.
Willey's Carbide Tool Co., Detroit, Mich.

DIES—Tantalum Carbide
Balloffet Dies & Nozzle Co., Inc., Guttenberg, N. J.
Carboloy Co., Inc., Detroit, Mich.
Firth-Sterling Steel Co., McKeesport, Pa.
Kelly Wire Die Corp., New York, N. Y.
Rusch Wire Die Corp., New York, N. Y.
Vascoloy-Ramet Corp., North Chicago, Ill.
Vianney Wire Die Works, New York, N. Y.
Willey's Carbide Tool Co., Detroit, Mich.

DIES—Tungsten Carbide
Balloffet Dies & Nozzle Co., Inc., Guttenberg, N. J.
Carboloy Co., Inc., Detroit, Mich.
Firth-Sterling Steel Co., McKeesport, Pa.
Kelly Wire Die Corp., New York, N. Y.
Rusch Wire Die Corp., New York, N. Y.
Tungsten Electric Corp., Union City, N. J.
Vascoloy-Ramet Corp., North Chicago, Ill.
Vianney Wire Die Works, New York, N. Y.
Willey's Carbide Tool Co., Detroit, Mich.

DIRECT ELECTRIC RESISTANCE HEATING—
Trauwood Engineering Co., Cleveland, Ohio.

DRAW BENCHES—
Ruesch, H. J., Machine Co., Newark, N. J.
Scudder, E. J., Foundry & Machine Co., Trenton, N. J.
Standard Machinery Co., Providence, R. I.
Vaughn Machinery Co., Cuyahoga Falls, O.

DRUMS—Flange Steel
Stevens Metal Products Co., Niles, O.

DRUMS—Vulcanizing
Mossberg Pressed Steel Corp., Attleboro, Mass.

DRYING EQUIPMENT—
Niagara Blower Co., Buffalo, N. Y.

ENGINEERS—Consulting Wire Mill
Hartley, George D., Worcester, Mass.
Lewis, Kenneth B., Worcester, Mass.

EQUIPMENT—Humidifying
Niagara Blower Co., Buffalo, N. Y.

EQUIPMENT—Industrial Cooling
Niagara Blower Co., Buffalo, N. Y.

EQUIPMENT—Insulation Testing
Davis, R. L., Electric Co., Wallingford, Conn.

EYELETS—Brass or Zinc
Platt Bros. & Co., The, Waterbury, Conn.

FLUXES—Soldering
American Chemical Paint Co., Ambler, Pa.

FOAM PRODUCING COMPOUNDS—
American Chemical Paint Co., Ambler, Pa.

FURNACES—Annealing
Carl-Mayer Corp., The, Cleveland, Ohio.
Electric Furnace Co., Salem, O.
Holden, A. F., Co., New Haven, Conn.
Rockwell, W. S., Co., New York, N. Y.
Surface Combustion, Div. of General Properties Co., Inc., Toledo, Ohio.
Trauwood Engineering Co., Cleveland, Ohio.
Wilson, Lee, Engr. Co., Cleveland, Ohio.

FURNACES—Automatic
Carl-Mayer Corp., The, Cleveland, Ohio.
Electric Furnace Co., Salem, O.
Rockwell, W. S., Co., New York, N. Y.
Surface Combustion, Div. of General Properties Co., Inc., Toledo, Ohio.
Wilson, Lee, Engr. Co., Cleveland, Ohio.

FURNACES—Brazing
Electric Furnace Co., Salem, O.
Firth-Sterling Steel Co., McKeesport, Pa.

FURNACES—Bright Annealing
Electric Furnace Co., Salem, O.
Rockwell, W. S., Co., New York, N. Y.
Surface Combustion, Div. of General Properties Co., Inc., Toledo, Ohio.
Wilson, Lee, Engr. Co., Cleveland, Ohio.

FURNACES—Electric
Electric Furnace Co., Salem, Ohio
Rockwell, W. S., Co., New York, N. Y.
Surface Combustion, Div. of General Properties Co., Inc., Toledo, Ohio
Trauwood Engineering Co., Cleveland, Ohio

FURNACES—Hardening & Tempering
Carl-Mayer Corp., The, Cleveland, Ohio
Electric Furnace Co., Salem, Ohio
Holden, A. F., Co., New Haven, Conn.
Rockwell, W. S., Co., New York, N. Y.
Surface Combustion, Div. of General Properties Co., Inc., Toledo, Ohio
Trauwood Engineering Co., Cleveland, Ohio

FURNACES—Lead Melting
Electric Furnace Co., Salem, Ohio
Robertson, John, Co., Brooklyn, N. Y.
Surface Combustion Div. of General Properties Co., Inc., Toledo, Ohio

FURNACES—Non-Oxidizing
Carl-Mayer Corp., The, Cleveland, Ohio
Electric Furnace Co., Salem, Ohio
Rockwell, W. S., Co., New York, N. Y.
Surface Combustion, Div. of General Properties Co., Inc., Toledo, Ohio

FURNACES—Normalizing
Carl-Mayer Corp., The, Cleveland, Ohio
Electric Furnace Co., Salem, Ohio
Rockwell, W. S., Co., New York, N. Y.
Surface Combustion Div. of General Properties Co., Inc., Toledo, Ohio

FURNACES—Pot (Oil, Gas and Electric)
Holden, A. F., Co., New Haven, Conn.

FURNACES—Salt Bath
Electric Furnace Co., Salem, Ohio
Holden, A. F., Co., New Haven, Conn.
Surface Combustion, Div. of General Properties Co., Inc., Toledo, Ohio.

FURNACES—Wire, Strip & Sheet
Carl-Mayer Corp., The, Cleveland, Ohio
Electric Furnace Co., Salem, Ohio
Rockwell, W. S., Co., New York, N. Y.
Surface Combustion, Div. of General Properties Co., Inc., Toledo, Ohio.
Wilson, Lee, Engr. Co., Cleveland, Ohio

GALVANIZING EQUIPMENT—
Wilson, Lee, Engr. Co., Cleveland, Ohio

GALVANIZING KETTLES—
National Annealing Box Co., Washington, Penna.

GRINDERS—Roll
Norton Co., Worcester, Mass.

HI-SPEED BAKERS—
Carl-Mayer Corp., The, Cleveland, Ohio

HOISTS—Electric Travelling
Cleveland Tramrail Div. of the Cleveland Crane & Engineering Co., Wickliffe, O.

INHIBITORS—Pickling
American Chemical Paint Co., Ambler, Pa.
Apex Alkali Products Co., Philadelphia, Pa.
Parkin, Wm. M., Co., The, Pittsburgh, Pa.

WHERE TO BUY, Continued

KETTLES—Galvanizing, Annealing, Tinning, etc.
National Annealing Box Co., Washington, Penna.

LATHES—Die Reaming
Morgan Construction Co., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.

LIME—
Warner Co., Bellefonte, Pa.

LUBRICANTS—For Metal Cutting, Stamping and Drawing
Magnus Chemical Co., Garwood, N. J.
Miller, R. H., Co., Inc., Homer, N. Y.
Standard Industrial Compounds Co., Chicago, Ill.

LUBRICANTS—Wire Drawing
Bick, Hans C., Inc., Reading, Pa.
Magnus Chemical Co., Garwood, N. J.
Miller, R. H., Co., Inc., Homer, N. Y.
Oakite Products, Inc., New York, N. Y.
Richards, G. Whitfield, Philadelphia, Pa.
Standard Industrial Compounds Co., Chicago, Ill.

MACHINERY—Armoring (Cable, Wire Hose)
American Insulating Mach'y. Co., Phila., Pa.
New England Butt Co., Providence, R. I.
Robertson, John, Co., Brooklyn, N. Y.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Rahway, N. J.
Thomson-Judd Wire Machinery Co., Sub. of Thomson-Gibb Electric Welding Co., Lynn, Mass.
Watson Machine Co., Paterson, N. J.

MACHINERY—Braiding
Fidelity Machine Co., Philadelphia, Pa.
New England Butt Co., Providence, R. I.
Robinson Mfg. Co., Muncy, Pa.
Watson Machine Co., Paterson, N. J.

MACHINERY—Brazing
Thomson-Judd Wire Machinery Co., Sub. of Thomson-Gibb Electric Welding Co., Lynn, Mass.

MACHINERY—Bunching
American Insulating Mach'y. Co., Phila., Pa.
New England Butt Co., Providence, R. I.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Rahway, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Bundling, Scrap
Sleeper & Hartley, Inc., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.
Watson Machine Co., Paterson, N. J.

MACHINERY—Cable, Electric
American Insulating Mach'y. Co., Phila., Pa.
Fidelity Machine Co., Philadelphia, Pa.
New England Butt Co., Providence, R. I.
Syncro Machine Co., Rahway, N. J.
Thomson-Judd Wire Machinery Co., Sub. of Thomson-Gibb Electric Welding Co., Lynn, Mass.
Watson Machine Co., Paterson, N. J.

MACHINERY—Chain Making
Nilson, A. H., Machine Co., The, Bridgeport, Conn.
Vaughn Machinery Co., Cuyahoga Falls, O.

MACHINERY—Closing
New England Butt Co., Providence, R. I.
Robinson Mfg. Co., Muncy, Pa.
Watson Machine Co., Paterson, N. J.

MACHINERY—Coil Winding
Robinson Mfg. Co., Muncy, Pa.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Rahway, N. J.

MACHINERY—Coilers
Broden Construction Co., Cleveland, Ohio
Morgan Construction Co., Worcester, Mass.
New England Butt Co., Providence, R. I.
Ruesch, H. J., Machine Co., Newark, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Rahway, N. J.
Torrington Manufacturing Co., The, Torrington, Conn.
Waterbury-Farrel Fdry. & Mach. Co., Waterbury, Conn.
Watson Machine Co., Paterson, N. J.

MACHINERY—Cold Heading with Wire Drawing Attachment
Ajax Manufacturing Co., Cleveland, Ohio

MACHINERY—Copper Wire Drawing and Rolling
Ruesch, H. J., Machine Co., Newark, N. J.
Syncro Machine Co., Rahway, N. J.
Torrington Manufacturing Co., The, Torrington, Conn.
Vaughn Machinery Co., Cuyahoga Falls, O.
Waterbury-Farrel Fdry. & Mach. Co., Waterbury, Conn.

MACHINERY—Covering Wire
Fidelity Machine Co., Philadelphia, Pa.
Syncro Machine Co., Rahway, N. J.

MACHINERY—Cutting
Ajax Manufacturing Co., Cleveland, Ohio
Broden Construction Co., Cleveland, Ohio
Lewis Machine Co., The, Cleveland, Ohio
Moslo Machinery, Inc., Cleveland, Ohio
National Machinery Exchange (Used), New York, N. Y.
Nilson, A. H., Machine Co., The, Bridgeport, Conn.
Shuster, F. B., Co., New Haven, Conn.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Rahway, N. J.
Torrington Manufacturing Co., The, Torrington, Conn.

MACHINERY—Die Making
Firth-Sterling Steel Co., McKeesport, Pa.

MACHINERY — Die Making for Forming Special Shapes
O'Neil-Irwin Mfg. Co., Minneapolis, Minn.

MACHINERY—Draw Benches
Ajax Manufacturing Co., Cleveland, Ohio
Standard Machinery Co., Providence, R. I.
Torrington Manufacturing Co., The, Torrington, Conn.

MACHINERY—Edging
Standard Machinery Co., Providence, R. I.
Torrington Manufacturing Co., The, Torrington, Conn.

MACHINERY—Enameling
American Insulating Mach'y. Co., Phila., Pa.
Syncro Machine Co., Rahway, N. J.

MACHINERY—Extruding
National Erie Corp., Erie, Pa.
Robertson, John, Co., Brooklyn, N. Y.
Royle, John, & Sons, Paterson, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Flat Wire
Broden Construction Co., Cleveland, Ohio
Ruesch, H. J., Machine Co., Newark, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.
Torrington Manufacturing Co., The, Torrington, Conn.

MACHINERY—Forming
National Machinery Exchange (Used), New York, N. Y.
Nilson, A. H., Machine Co., The, Bridgeport, Conn.
Sleeper & Hartley, Inc., Worcester, Mass.
Standard Machinery Co., Providence, R. I.
Torrington Manufacturing Co., The, Torrington, Conn.

MACHINERY—Galvanizing
Broden Construction Co., Cleveland, O.
Sleeper & Hartley, Inc., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.
Wilson, Lee, Engr. Co., Cleveland, Ohio.

MACHINERY—Galvanizing Wire
Wilson, Lee, Engr. Co., Cleveland, Ohio.

MACHINERY—Gang Winders
Fidelity Machine Co., Philadelphia, Pa.
Robinson Mfg. Co., Muncy, Pa.
Ruesch, H. J., Machine Co., Newark, N. J.
Syncro Machine Co., Rahway, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Grinding
Norton Co., Worcester, Mass.

MACHINERY—Insulating
American Insulating Mach'y Co., Phila., Pa.
Fidelity Machine Co., Philadelphia, Pa.
New England Butt Co., Providence, R. I.
Royle, John, & Sons, Paterson, N. J.
Syncro Machine Co., Rahway, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Knitting
Fidelity Machine Co., Philadelphia, Pa.

MACHINERY—Lead Encasing Presses, etc.
Robertson, John, Co., Brooklyn, N. Y.

MACHINERY—Lead Stripping
Robertson, John, Co., Brooklyn, N. Y.
Watson Machine Co., Paterson, N. J.

MACHINERY—Lock Washer
Sleeper & Hartley, Inc., Worcester, Mass.
Torrington Mfg. Co., The, Torrington, Conn.

MACHINERY—Magnet Wire
American Insulating Mach'y Co., Phila., Pa.
New England Butt Co., Providence, R. I.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Rahway, N. J.
Torrington Mfg. Co., The, Torrington, Conn.

MACHINERY—Material Handling
Cleveland Tramrail Div. of the Cleveland Crane & Engineering Co., Wickliffe, Ohio.

MACHINERY — Measuring Wire & Cable
Davis, R. L., Electric Co., Wallingford, Conn.
Durant Mfg. Co., Milwaukee, Wis.
Lyon-Vail Machine Co., Brockton, Mass.
New England Butt Co., Providence, R. I.
Robinson Mfg. Co., Muncy, Pa.
Watson Machine Co., Paterson, N. J.

MACHINERY—Nail and Tack
Glader, Wm., Machine Works, Chicago, Ill.
National Machinery Exchange (Used), New York, N. Y.
Sleeper & Hartley, Inc., Worcester, Mass.

MACHINERY—Panning
American Insulating Mach'y Co., Phila., Pa.
Syncro Machine Co., Rahway, N. J.

MACHINERY—Pointing
Broden Construction Co., Cleveland, Ohio
Ruesch, H. J., Machine Co., Newark, N. J.
Scudder, E. J., Fdry. & Mach. Co., Trenton, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.
Standard Machinery Co., Providence, R. I.
Superior Tool & Mfg. Co., Worcester, Mass.
Syncro Machine Co., Rahway, N. J.
Torrington Manufacturing Co., The, Torrington, Conn.
Vaughn Machinery Co., Cuyahoga Falls, O.
Waterbury-Farrel Fdry. & Mach. Co., Waterbury, Conn.

MACHINERY—Quill Winding
Fidelity Machine Co., Philadelphia, Pa.

MACHINERY—Rod Mill
Broden Construction Co., Cleveland, Ohio
Morgan Construction Co.. Worcester, Mass.
Ruesch, H. J., Machine Co., Newark, N. J.

MACHINERY—Rolling Mill
Broden Construction Co., Cleveland, Ohio
Morgan Construction Co., Worcester, Mass.
National Machinery Exchange (Used), New York, N. Y.
Ruesch, H. J., Machine Co., Newark, N. J.
Standard Machinery Co., Providence, R. I.
Syncro Machine Co., Rahway, N. J.
Torrington Manufacturing Co., The, Torrington, Conn.
Waterbury-Farrel Fdry. & Mach. Co., Waterbury, Conn.

MACHINERY—Rubber for Insulating Wire
National Erie Corp., Erie, Pa.
Royle, John, & Sons, Paterson, N. J.

MACHINERY—Rubber Strip Covering
New England Butt Co., Providence, R. I.
Watson Machine Co., Paterson, N. J.

MACHINERY—Rubber Tubing and Straining
New England Butt Co., Providence, R. I.
Royle, John, & Sons, Paterson, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.
Torrington Manufacturing Co., The, Torrington, Conn.
Watson Machine Co., Paterson, N. J.

MACHINERY—Screw Wire
National Machinery Exchange (Used), New York, N. Y.
Sleeper & Hartley, Inc., Worcester, Mass.

MACHINERY—Special
American Insulating Mach'y Co., Phila., Pa.
Broden Construction Co., Cleveland, Ohio
Emory, Robert J., Co., Newark, N. J.
New England Butt Co., Providence, R. I.
Robinson Mfg. Co., Muncy, Pa.
Ruesch, H. J., Machine Co., Newark, N. J.
Scudder, E. J., Fdry. & Mach. Co., Trenton, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.
Standard Machinery Co., Providence, R. I. (Special Designs)
Superior Tool & Mfg. Co., Worcester, Mass.
Syncro Machine Co., Rahway, N. J.
Torrington Manufacturing Co., The, Torrington, Conn.
Watson Machine Co., Paterson, N. J.

MACHINERY—Spooling
American Insulating Mach'y Co., Phila., Pa.
Emory, Robert J., Co., Newark, N. J.
Fidelity Machine Co., Philadelphia, Pa.
New England Butt Co., Providence, R. I.
Robinson Mfg. Co., Muncy, Pa.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Rahway, N. J.
Torrington Manufacturing Co., The, Torrington, Conn.
Vaughn Machinery Co., Cuyahoga Falls, O.
Waterbury-Farrel Fdry. & Mach. Co., Waterbury, Conn.
Watson Machine Co., Paterson, N. J.

MACHINERY—Spring Making
National Machinery Exchange (Used), New York, N. Y.
Sleeper & Hartley, Inc., Worcester, Mass.
Torrington Mfg. Co., The, Torrington, Conn.

WHERE TO BUY, Continued

MACHINERY—Staple
Sleeper & Hartley, Inc., Worcester, Mass.

MACHINERY—Straightening
Ajax Manufacturing Co., Cleveland, Ohio
Broden Construction Co., Cleveland, Ohio
Lewis Machine Co., The, Cleveland, Ohio
Moslo Machinery Co., Cleveland, Ohio
National Machinery Exchange (Used), New York, N. Y.
Nilson, A. H., Machine Co., The, Bridgeport, Conn.
Ruesch, H. J., Machine Co., Newark, N. J.
Shuster, F. B., Co., New Haven, Conn.
Sleeper & Hartley, Inc., Worcester, Mass.
Superior Tool & Mfg. Co., Worcester, Mass.
Torrington Manufacturing Co., The, Torrington, Conn.

MACHINERY—Stranding
New England Butt Co., Providence, R. I.
Robinson Mfg. Co., Muncy, Pa.
Sleeper & Hartley, Inc., Worcester, Mass.
Thomson-Judd Wire Machinery Co., Sub. of Thomson-Gibb Electric Welding Co., Lynn, Mass.
Watson Machine Co., Paterson, N. J.

MACHINERY—Strip Steel
Broden Construction Co., Cleveland, Ohio
Ruesch, H. J., Machine Co., Newark, N. J.
Torrington Manufacturing Co., The, Torrington, Conn.

MACHINERY—Swaging
National Machinery Exchange (Used), New York, N. Y.
Ruesch, H. J., Machine Co., Newark, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.
Standard Machinery Co., Providence, R. I.
Syncro Machine Co., Rahway, N. J.
Waterbury-Farrel Fdry. & Mach. Co., Waterbury, Conn.

MACHINERY—Taping
American Insulating Mach'y Co., Phila., Pa.
Fidelity Machine Co., Philadelphia, Pa.
New England Butt Co., Providence, R. I.
Syncro Machine Co., Rahway, N. J.
Thomson-Judd Wire Machinery Co., Sub. of Thomson-Gibb Electric Welding Co., Lynn, Mass.
Watson Machine Co., Paterson, N. J.

MACHINERY—Testing
Robinson Mfg. Co., Muncy, Pa.
Scott, Henry L., Co., Providence, R. I.

MACHINERY—Testing Size of Wire
Davis, R. L., Electric Co., Wallingford, Conn.

MACHINERY—Testing Spring
Standard Machinery Co., Providence, R. I.

MACHINERY—Tinsel Rolling Mills
American Insulating Mach'y Co., Phila., Pa.
Syncro Machine Co., Rahway, N. J.
Torrington Manufacturing Co., The, Torrington, Conn.

MACHINERY—Trolley Wire
Vaughn Machinery Co., Cuyahoga Falls, O.
Torrington Manufacturing Co., The, Torrington, Conn.

MACHINERY—Tube Mill
Ruesch, H. J., Machine Co., Newark, N. J.
Torrington Manufacturing Co., The, Torrington, Conn.

MACHINERY—Welding Wire
Micro Products Co., Chicago, Ill.
Shuster, F. B., Co., New Haven, Conn.
Thomson-Judd Wire Machinery Co., Sub. of Thomson-Gibb Electric Welding Co., Lynn, Mass.

MACHINERY—Winding
American Insulating Mach'y Co., Phila., Pa.
Fidelity Machine Co., Philadelphia, Pa.
New England Butt Co., Providence, R. I.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Rahway, N. J.
Torrington Mfg. Co., The, Torrington, Conn.
Watson Machine Co., Paterson, N. J.

MACHINERY—Wire Bending
O'Neil-Irwin Mfg. Co., Minneapolis, Minn.

MACHINERY—Wire Drawing
Ajax Manufacturing Co., Cleveland, Ohio
American Insulating Mach'y Co., Phila., Pa.
Broden Construction Co., Cleveland, Ohio
Morgan Construction Co., Worcester, Mass.
National Machinery Exchange (Used), New York, N. Y.
Robinson Mfg. Co., Muncy, Pa.
Ruesch, H. J., Machine Co., Newark, N. J.
Scudder, E. J., Fdry. & Mach. Co., Trenton, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.
Standard Machinery Co., Providence, R. I.
Superior Tool & Mfg. Co., Worcester, Mass.
Syncro Machine Co., Rahway, N. J.
Thomson-Judd Wire Machinery Co., Sub. of Thomson-Gibb Electric Welding Co., Lynn, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.
Waterbury-Farrel Fdry. & Mach. Co., Waterbury, Conn.

MACHINERY—Wire Measuring
Durant Mfg. Co., Milwaukee, Wis.
Lyon-Vail Machine Co., Inc., Brockton, Mass.
Watson Machine Co., Paterson, N. J.

MACHINERY—Wire Rope
New England Butt Co., Providence, R. I.
Robinson Mfg. Co., Muncy, Pa.
Thomson-Judd Wire Machinery Co., Sub. of Thomson-Gibb Electric Welding Co., Lynn, Mass.
Watson Machine Co., Paterson, N. J.

MACHINERY—Wire Tinning
American Insulating Mach'y Co., Phila., Pa.
New England Butt Co., Providence, R. I.
Syncro Machine Co., Rahway, N. J.

MACHINERY—Wood Screw
National Machinery Exchange (Used), New York, N. Y.

MATERIAL HANDLING EQUIPMENT
Cleveland Tramrail Div. of the Cleveland Crane & Engineering Co., Wickliffe, O.

METAL CLEANING—Dry Process
Dreisbach Engr. Corp., Yonkers, N. Y.

MILLS—Metal Reclaiming
Dreisbach Engr. Corp., Yonkers, N. Y.

MILLS—Tandem Rolling and Edging
Standard Machinery Co., Providence, R. I.
Torrington Manufacturing Co., The, Torrington, Conn.

NICKEL SILVER AND PHOSPHOR BRONZE—Rod, Wire and Strip
Hudson Wire Co., Ossining, N. Y.

OILS—Wire Drawing
Richards, G. Whitfield, Philadelphia, Pa.
Standard Industrial Compounds Co., Chicago, Ill.

OVENS—Cable Lacquering
Industrial Oven Engr. Co., Cleveland, Ohio

OVENS—Industrial
Carl-Mayer Corp., The, Cleveland, Ohio
Industrial Oven Engr. Co., Cleveland, Ohio
Ross, J. O., Engineering Corp., New York, N. Y.

PAINTS—Heat Resisting
American Chemical Paint Co., Ambler, Pa.

PAINTS—Marine
American Chemical Paint Co., Ambler, Pa.

PAINTS—Structural Steel
American Chemical Paint Co., Ambler, Pa.

PANS—Lead and Spelter
National Annealing Box Co., Washington, Penna.

PANS—Vulcanizing
Mossberg Pressed Steel Corp., Attleboro, Mass.

PAPER—Creped Wrapping
Crepe-Kraft Co., Newark, N. J.

PAPER TESTERS—
Scott, Henry L., Co., Providence, R. I.

PATENT ATTORNEYS—
Lancaster, Allwine and Rommel, Washington, D. C.

PICKLING COMPOUNDS—
American Chemical Paint Co., Ambler, Pa.
Parkin, Wm. M., Co., The, Pittsburgh, Pa.

PICKLING TANK LININGS—
Keagler Brick Co., Steubenville, Ohio.

PLASTIC TESTERS—
Scott, Henry L., Co., Providence, R. I.

POTS—Lead Melting
Robertson, John, Co., Brooklyn, N. Y.

POWDER—Wire Drawing
Richards, G. Whitfield, Philadelphia, Pa.

PRESSES—Hydraulic and Mechanical
Robertson, John, Co., Brooklyn, N. Y.
Standard Machinery Co., Providence, R. I. (Mechanical Only)

PRESSES—Lead
Robertson, John, Co., Brooklyn, N. Y.

PRESSURE VESSELS—
National Annealing Box Co., Washington, Penna.

PULLERS—Wire
Scudder, E. J., Fdry. & Mach. Co., Trenton, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.

PUMPS—Hydraulic
Robertson, John, Co., Brooklyn, N. Y.

QUENCHING BATH CONTROLS—
Niagara Blower Co., Buffalo, N. Y.

REEL AND TENSION STAND—
Fidelity Machine Co., Philadelphia, Pa.
Moslo Machinery Co., Cleveland, Ohio
Robinson Mfg. Co., Muncy, Pa.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Rahway, N. J.

REEL CRUTCHES—
Watson Machine Co., Paterson, N. J.

REELS—Annealing and Stranding
Apco Mossberg Co., Attleboro, Mass.
Hubbard Spool Co., Chicago, Ill.
Moslo Machinery Co., Cleveland, Ohio
Mossberg Pressed Steel Corp., Attleboro, Mass.
Shuster, F. B., Co., New Haven, Conn.
Stevens Metal Products Co., Niles, O.

REELS—Steel
Apco Mossberg Co., Attleboro, Mass.
Hubbard Spool Co., Chicago, Ill.
Mossberg Pressed Steel Corp., Attleboro, Mass.
Stevens Metal Products Co., Niles, O.

REELS AND SPOOLS—Shipping and Shop
Apco Mossberg Co., Attleboro, Mass.
Hubbard Spool Co., Chicago, Ill.
Mossberg Pressed Steel Corp., Attleboro, Mass.
Stevens Metal Products Co., Niles, O.

REELS—Takeoff
Apco Mossberg Co., Attleboro, Mass.
Hubbard Spool Co., Chicago, Ill.
Moslo Machinery Co., Cleveland, Ohio
Mossberg Pressed Steel Corp., Attleboro, Mass.
Shuster, F. B., Co., New Haven, Conn.
Stevens Metal Products Co., Niles, O.

REELS—Vulcanizing and Impregnating
Apco Mossberg Co., Attleboro, Mass.
Hubbard Spool Co., Chicago, Ill.
Mossberg Pressed Steel Corp., Attleboro, Mass.
Shuster, F. B., Co., New Haven, Conn.
Stevens Metal Products Co., Niles, O.

REELS—Wire Drawing
Apco Mossberg Co., Attleboro, Mass.
Hubbard Spool Co., Chicago, Ill.
Moslo Machinery Co., Cleveland, Ohio
Mossberg Pressed Steel Corp., Attleboro, Mass.
Stevens Metal Products Co., Niles, O.

REFRACTORIES—High Temperature
Norton Co., Worcester, Mass.

ROD BAKERS—
Carl-Mayer Corp., The, Cleveland, Ohio
Moslo Machinery Co., Cleveland, Ohio
Ross, J. O., Engineering Corp., New York, N. Y.

RODS—Wire—Non-Ferrous
American Brass Co., The, Waterbury, Conn.
Hudson Wire Co., Ossining, N. Y.
Platt Bros. & Co., The, Waterbury, Conn.

RODS—Wire—Steel
Bethlehem Steel Co., Bethlehem, Pa.
Continental Steel Corp., Kokomo, Indiana.
Jones & Laughlin Steel Corp., Pittsburgh, Pa.
Keystone Steel & Wire Co., Peoria, Ill.

ROLL STRAIGHTENERS—
Moslo Machinery Co., Cleveland, Ohio

RUBBER AND RUBBER COMPRESSION TESTERS—
Scott, Henry L., Co., Providence, R. I.

RUST PROOF COMPOUNDS—
American Chemical Paint Co., Ambler, Pa.

RUST REMOVING COMPOUNDS—
American Chemical Paint Co., Ambler, Pa.

SHEARS—
O'Neil-Irwin Mfg. Co., Minneapolis, Minn.

SHEET—Steel
Continental Steel Corp., Kokomo, Ind.
Jones & Laughlin Steel Corp., Pittsburgh, Pa.

SOAPS—Industrial and Wire Drawing
Magnus Chemical Co., Garwood, N. J.
Miller, R. H., Co., Inc., Homer, N. Y.
Standard Industrial Compounds Co., Chicago, Ill.

SPOOLS—Annealing and Wire Drawing
Apco Mossberg Co., Attleboro, Mass.
Hubbard Spool Co., Chicago, Ill.
Mossberg Pressed Steel Corp., Attleboro, Mass.
Stevens Metal Products Co., Niles, O.

SPOOLS—Shipping and Shop
Apco Mossberg Co., Attleboro, Mass.
Hubbard Spool Co., Chicago, Ill.
Mossberg Pressed Steel Corp., Attleboro, Mass.
Stevens Metal Products Co., Niles, O.

SPOOLS—Steel
Apco Mossberg Co., Attleboro, Mass.
Hubbard Spool Co., Chicago, Ill.
Mossberg Pressed Steel Corp., Attleboro, Mass.

WHERE TO BUY, Continued

Stevens Metal Products Co., Niles, O.

STAMPINGS—Steel
Hubbard Spool Co., Chicago, Ill
Mossberg Pressed Steel Corp., Attleboro, Mass.

STRIP—Brass and Non-Ferrous
Hudson Wire Co., Ossining, N. Y.

STRIP—Steel
Bethlehem Steel Co., Bethlehem, Pa.
Continental Steel Corp., Kokomo, Ind.
Firth-Sterling Steel Co., McKeesport, Pa.
Jones & Laughlin Steel Corp., Pittsburgh, Pa.
Seneca Wire & Mfg. Co., The, Fostoria, O.

STRIP METAL TESTERS—
Scott, Henry L., Co., Providence, R. I.

SWIFTS—Take-off
Apco Mossberg Co., Attleboro, Mass.
Mossberg Pressed Steel Corp., Attleboro, Mass.

TANK LININGS—Brick
Keagler Brick Co., Steubenville, Ohio.

TANKS—Compound
Watson Machine Co., Paterson, N. J.

TANKS—Steel
Mossberg Pressed Steel Corp., Attleboro, Mass.

TEMPERATURE CONTROLS—
Niagara Blower Co., Buffalo, N. Y.

TENSILE TESTERS—
Scott, Henry L., Co., Providence, R. I.

TESTING INSTRUMENTS—
Scott, Henry L., Co., Providence, R. I.

TOOLS—Wire Cutting
Porter, H. K., Inc., Everett, Mass.

TRAMRAIL SYSTEMS—
Cleveland Tramrail Div. of the Cleveland Crane & Engineering Co., Wickliffe, O.

TREADS—Safety
Norton Co., Worcester, Mass.

TRUCKS—
Morgan Construction Co., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.

TUBE BENDERS AND FORMERS—
Ruesch, H. J., Machine Co., Newark, N. J.

TURKS HEADS—Friction and Power Driven
Standard Machinery Co., Providence, R. I.

VULCANIZERS—
Watson Machine Co., Paterson, N. J.

VULCANIZING PANS—
American Insulating Mach'y Co., Phila., Pa.
Mossberg Pressed Steel Corp., Attleboro, Mass.

WELDERS—Spot and Butt
Micro Products Co., Chicago, Ill.
Moslo Machinery Co., Cleveland, Ohio

WIRE—Cold Heading
Bethlehem Steel Co., Bethlehem, Pa.
Continental Steel Corp., Kokomo, Indiana.
Jones & Laughlin Steel Corp., Pittsburgh, Pa.
Keystone Steel & Wire Co., Peoria, Ill.

WIRE DRAWING—High Grade Custom
Hy-Carbo Steel Co., Lowell, Mass.

WIRE—Electric
American Brass Co., The, Waterbury, Conn.
Hudson Wire Co., Ossining, N. Y.

WIRE—Enameled for Coils
Winsted Div. of Hudson Wire Co., Winsted, Conn.

WIRE—Manufacturers
Bethlehem Steel Co., Bethlehem, Pa.
Continental Steel Corp., Kokomo, Ind.
Firth-Sterling Steel Co., McKeesport, Pa.
Jones & Laughlin Steel Corp., Pittsburgh, Pa.
Keystone Steel & Wire Co., Peoria, Ill.
Seneca Wire & Mfg. Co., The, Fostoria, O.
Wickwire Bros., Inc., Cortland, N. Y.

WIRE—Music
Harris, F. A., Inc., Springfield, Mass.
Jersey Steel & Wire Corp., Irvington, N. J.

WIRE—Nickel Silver and Phosphor Bronze
American Brass Co., The, Waterbury, Conn.
Callite Tungsten Corp., Union City, N. J.
Hudson Wire Co., Ossining, N. Y.

WIRE—Non-Ferrous to Specification for Special Purposes
American Brass Co., The, Waterbury, Conn.
Harris, F. A., Inc., Springfield, Mass.
Callite Tungsten Corp., Union City, N. J.
Hudson Wire Co., Ossining, N. Y.
Winsted Div. of Hudson Wire Co., Winsted, Conn.

WIRE—Spring
American Brass Co., The, Waterbury, Conn.
Bethlehem Steel Co., Bethlehem, Pa.
Continental Steel Corp., Kokomo, Ind.
Firth-Sterling Steel Co., McKeesport, Pa.
Harris, F. A., Inc., Springfield, Mass.
Jones & Laughlin Steel Corp., Pittsburgh, Pa.
Keystone Steel & Wire Co., Peoria, Ill.
Seneca Wire & Mfg. Co., The, Fostoria, O.

WIRE—Stainless Steel
Callite Tungsten Corp., Union City, N. J.
Firth-Sterling Steel Co., McKeesport, Pa.
Harris, F. A., Inc., Springfield, Mass.

WIRE—Steel—Also Coppered Steel—Also Galvanized Steel
Bethlehem Steel Co., Bethlehem, Pa.
Continental Steel Corp., Kokomo, Ind.
Jones & Laughlin Steel Corp., Pittsburgh, Pa.
Keystone Steel & Wire Co., Peoria, Ill.
Seneca Wire & Mfg. Co., The, Fostoria, O.
Wickwire Bros., Inc., Cortland, N. Y.

WIRE AND STRIP—Zinc
Platt Bros. & Co., The, Waterbury, Conn.

WIRE TESTERS—
Scott, Henry L., Co., Providence, R. I.

WIRE, WEAVING—Non-Ferrous
American Brass Co., The, Waterbury, Conn.
Hudson Wire Co., Ossining, N. Y.

WRAPPING PAPER—Creped
Crepe-Kraft Co., Newark, N. J.

YARN TESTERS—
Scott, Henry L., Co., Providence, R. I.

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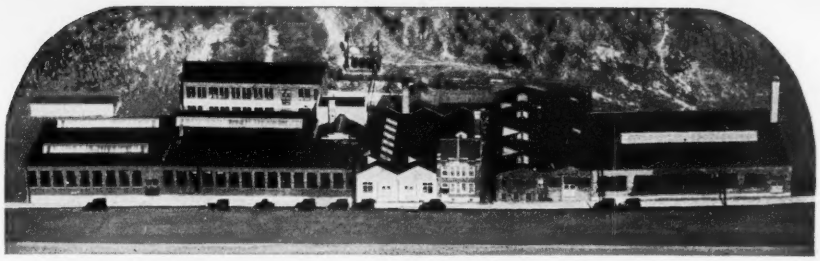

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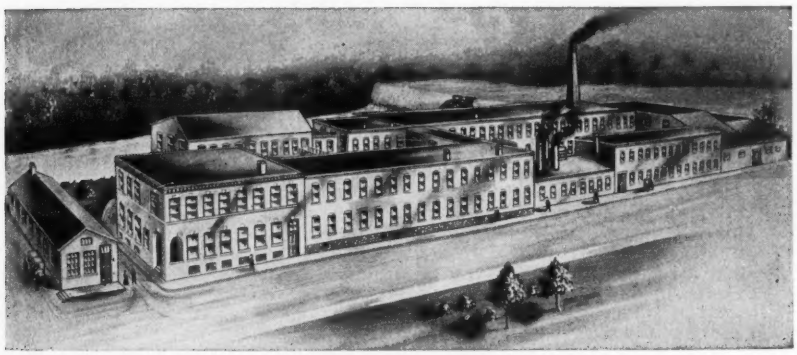

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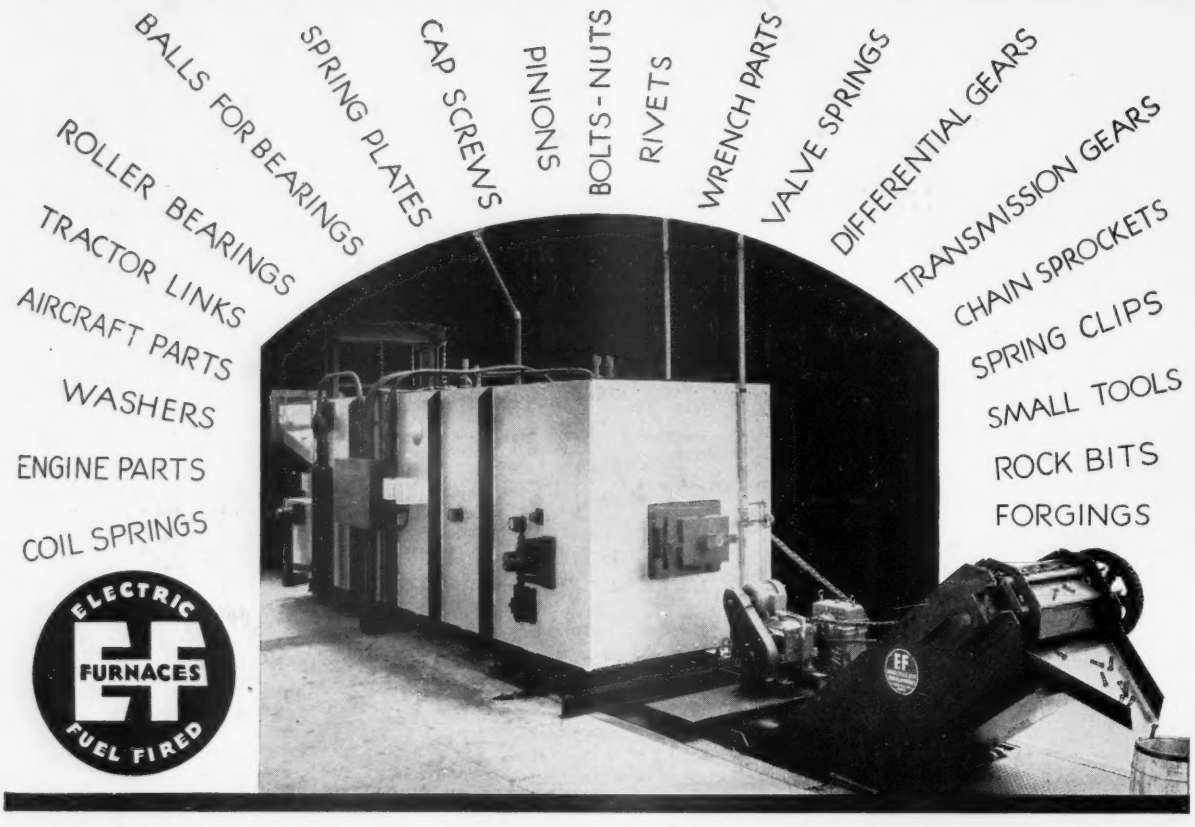

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